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Electrical Salesmanship: New Men and New Ideas.

THE holding of the annual conference of the Municipal Tramways Association, the reversion to normal time after "summer-time," and the receipt of the new sessional programme of Salesmanship Conferences, remind us that the year is far spent. The past half-year has been so full of work for everybody electrical, thanks to the Exhibition and the various conferences, that we have failed to notice the "summer" as it has passed.

Attention will still require to be concentrated upon the Exhibition for nearly two months to come, and no doubt during that period a good deal of trade will be done, and the electrical education of the public will be continued. But the British Electrical Development Association, notwithstanding the occupation of a large part of its staff with excellent and successful activities at Wembley, has had to look ahead as well during the whole period. Preparations have had to be made for the continuation of the Wembley popularisation movement after the Exhibition doors are closed, and in addition Mr. J. W. Beauchamp has had to make plans for the salesmanship conferences of the coming winter months.

The programme of the London series is published in our "Business Notices" to-day, and we take this opportunity of once again emphasising the fact that the conferences are open, free of charge and without admission tickets, to everyone connected with the electrical industry, though more particularly to those who are directly or indirectly engaged on the selling side of electricity supply undertakings and manufacturing and contracting firms.

We hope that there will be a strong determination on the part of those concerned to ensure the thorough success of these proceedings. The voice of the critic has not been silent with regard to past sessions. That is just as well, for unless suggestions are forthcoming from those who feel that the meetings might be made more useful to the rank and file engaged in electrical development work there is the danger that one session may be very like another, and that familiar voices may become too familiar, depriving the new man of an opportunity of taking part in the discussions.

After all it matters comparatively little who takes part in the proceedings, or whether he is an accomplished orator or not, so long as good ideas and good thoughts can be added to the common stock and help things forward generally. There is not the slightest doubt that many things are never contributed to our public discussions because the men who know them from practical observation and experience do not care to "let themselves go"—either they are naturally reticent and retiring or they wonder how far it will be politic for them to do so in the presence of their superior officers.

There may be many things in their minds that they would like to say, but they are afraid that they may "give the show away" if they do so, and thus incur somebody's displeasure. But that, we hope, is quite a remote possibility, and we urge them to take their courage in both hands and run the risk. If they are silent when they ought to speak, the rest of us are thereby deprived of valuable information unless they can be persuaded to put it into writing and to forward it to the Electrical Review.

What the industry should look for at these conferences is the expression of ideas which will stimulate thought and activity with reference to new means for promoting bigger sales of everything electrical—including, of course, electricity itself. There is room for greater originality—we want to get out of ruts and keep out of them; we do not want to sit listening to platitudes when there are amongst us those who can open new stores of knowledge and show us that practical experience is exploding preconceived ideas and proving that there may be new and better ways of securing the end that we all have in view. Let it not be overlooked that: "The object of these conferences is to secure a free interchange of experience on the day-to-day problems of salesmen and commercial assistants, with a view to promoting knowledge and better understanding of modern principles of selling, and at the same time to improving he prospects of those engaged in the work." We hope the meetings of the session which opens on Friday next will be marked by the freest possible interchange of thought along these lines. The proceedings should be conducted in an atmosphere of liberty, freedom from restraint, and even of delightful informality, in which men conversationally recite their experiences. To "discover" men of genius, and to mark those of special promise and of exceptional ability, are good ends gained no doubt, but we should be less out for "men" than for information, data, and ideas which shall raise the general standard of electrical business-getting excellence.

Electricity Used Dangerously.

We have on previous occasions drawn attention to the fact that electricity, which is in most parts of a house absolutely harmless, may be a source of danger in the bathroom, and that lives have been lost through its improper use there. Unless exceptional precautions are employed, no portable apparatus should be used in a bathroom and no metal that may conceivably become "alive" should be exposed within six feet of the bath or wash basin, or any taps or pipes connected with earth. In the new Regulations of the I.E.E. this requirement, which had previously been indicated in general terms, is explicitly emphasised, and the warning is extended even to the lampholder. In our last issue Mr. J. C. White pointed out the undoubted fact that in the scullery, cellar, and washhouse the danger might be even more real, unless the proper precautions were taken.

We do not wish to lay undue stress upon the point; the experience of a quarter of a century of the use of pressures of 200 volts and upwards in dwellings proves that the risk is really very slight, and it can readily be reduced to a negligible quantity by the exercise of common sense.

Another situation in which the careless use of electricity from the supply mains may lead to disaster is described in our "Correspondence" columns to-day—namely, in hairdressers' shops, which necessarily contain earthed metal and water. Electric hair-wavers and hair-driers which are not in sound condition may there, in the hands of operators ignorant of electrical phenomena, give rise to dangerous and even fatal shocks, or by short-circuit may set the hair of a customer on fire, with disastrous results. Such apparatus should not be installed except under competent supervision, and should be inspected from time to time; the slightest accident would be widely retailed and expanded, and would bring discredit upon the electrical industry. The safest plan, where alternating current is available, is to reduce the pressure to 50 volts with a double-wound transformer (not an auto-transformer), for use with apparatus in such cases.

Another possibility of danger arises from the introduction of broadcasting. The wearer of a headphone which happens to be faulty may, in effect, have an earthplate clamped to his head, or hers, and on picking up an electric kettle or other device which is likewise faulty may have a very unpleasant experience. We have not heard of any such incident, and hope we never shall; but the possibility exists. Here, again, occasional inspection is desirable.

Contract Conditions.

One of the ways in which this journal endeavoured in pre-association days—we believe with considerable success—to assist the manufacturers of plant and machinery required for electrical installations was the regular selection for criticism in these pages of specifications issued by municipal corporations and other authorities. The mind is carried back to many remarkable clauses and provisions embodied in the specifications with which we dealt, by the good work that is now being pursued by the Federation of British Industries. The sifting process to which we subjected those "current specifications" was continued over a lengthy period and gradually led to an improvement, a number of objectionable features disappearing, but in recent years there has been necessity for further action to be taken by the F.B.I. and other organisations. There is a need for constant watchfulness where weeds can so easily recur and both Press publicity and manufacturers' organised joint action are necessary to prevent the choking of the specification soil with harsh and arbitrary clauses. For some time past the Contracts Committee of the Federation has been conducting an inquiry into these matters in the hope of securing, if not the elimination, at any rate the amelioration, of such clauses. It first drew up a set of clauses, as a basis for recommended standardised conditions covering arbitration, delay in delivery, damages for delay, liability for accidents and damage, and general liability to the contractor. Government Departments were urged to adopt an independent arbitration clause in all contracts for the supply of goods, and a number of them agreed to do so while others, including the G.P.O., are considering the matter. Negotiations are being opened with municipalities and other large purchasing bodies and, according to the last issue of the Federation *Bulletin*, the scope will in due course be extended to contracts for engineering and constructional works. So far so good with regard to independent arbitration. Now the Committee is about to proceed further and press for the adoption of standardised clauses for delay in delivery and the other fundamental conditions mentioned above. To this end draft clauses have been prepared, and the views of members thereon are being invited.

Electricity Workers' Wages.

On Monday last the inquiry with regard to the wages of the manual workers in electricity supply undertakings, which was entrusted to a special tribunal under the chairmanship of Mr. W. Addington Willis by the Minister of Labour at the request of the National Joint Industrial Council, was terminated.

The workers in July claimed an advance of 10s. a week, which the employers declined to concede. It is interesting to note that, owing to the municipalisation

in great part of the industry, the majority of the workers concerned are in the employ of local authorities; and practically the whole of them are engaged in a public utility service. At first it was feared that a strike would be the outcome of the demand, although the employers offered to refer it to arbitration; fortunately, however, the trade unions concerned eventually agreed to the holding of an inquiry—fortunately, that is, for the public, which might otherwise have been put to grave inconvenience; and fortunately for themselves, for if they had refused to go to arbitration the weight of the technical staffs would surely have been thrown into the scale against them and the strike would have had little chance of success.

With the merits of the question before the Tribunal, we are not disposed to deal; many considerations are involved, and various grades of skilled labour are included amongst the trades represented in the industry. It is notorious that in the engineering industries generally the standard of wages is far below that enjoyed by workers in the building trades, by railwaymen, and some other classes who cannot claim to be equally skilled in their trades; no remedy can be found for this very regrettable condition, in view of the pressure of foreign competition fostered by long hours and very low wages abroad. The building trades, like the railways, are shielded by locality from such pressure, and the former especially have succeeded in building a ring fence round their industry which restricts the labour market and maintains an artificial standard of value for skilled labour. The Tribunal will decide whether, as is alleged by their representatives, the economic conditions of the workers are worse now than in 1914, and whether, as employers' witnesses state, their average wages are already higher than in other industries of similar standing.

But there is one aspect of the matter to which we would direct attention—namely, the argument advanced by Mr. J. Rowan that the industry, being a sheltered one, could afford to pay higher wages than those which were subject to competition.

Mr. Rowan doubtless had in mind the monopoly granted to an electricity supply undertaking within its statutory area, dismissing the competition of gas as negligible, and ignoring that of private installations. In effect, though for quite different reasons, the position of the electricity supply industry is similar to that of the building trades and the railways, and the same principle underlies his argument: the public must come to us for the commodity that we supply—make the public pay for the privilege!

The basic principle of democracy, we believe, is that so tersely enunciated by Abraham Lincoln: "Government of the people by the people, for the people." *For* the people. And that of socialism, according to authority, is that individual freedom should be completely subordinated to the interests of the community. There seems to prevail an idea, however, at the bottom of the minds of those who most strenuously proclaim adhesion to democratic and socialistic ideals, that the community is a sort of cow, existing only to be milked, and that if you can drive it into a corner it is your cow.

As we have indicated above, we have an open mind as to the justice of the claim for increased wages; we seek contentment throughout the whole of the electrical industry, and that is worth paying for, if it results in stability and in continuity of the supply of electricity—to "the public." And we may admire the candour with which Mr. Rowan states his case. But none the less, we cannot approve of the ground upon which he bases it, which is simply that "the public" is defenceless against a monopoly.

Lessons from Gas.

From the presidential address of Mr. J. W. McLusky to the North British Association of Gas Managers in Glasgow, where he is at the head of the Corporation Gas Department, some useful hints may be gathered by managers of electrical undertakings.

In connecting new consumers or adding to existing installations, the Glasgow Gas Department has enlisted the aid of the master plumbers of the city, to whom no fewer than 26,000 orders were passed on last year. By this method delay in connection is minimised, thus gratifying the consumer, and the goodwill of the plumbers is retained.

A particularly interesting feature of the address was the reference to maintenance service, which in Glasgow is being developed on a house-to-house basis; it was soon discovered that "efficiency was the exception and not the rule." The cost of the service has proved to be less than 1½d. per thousand cubic feet consumed, and the consumers "are delighted with the innovation and are prepared to pay for it." Moreover, more orders for appliances are received through the maintenance fitters than from any other source. The scheme has proved so satisfactory that it has been decided to extend the service to the whole area. Already over 410,000 appliances are being maintained, at an average annual cost of 6.12d. each, in more than 213,000 premises, by a staff of 136 persons. We cannot too strongly urge the adoption of a similar policy upon the managers of electricity supply undertakings, if they really wish to make the most of the opportunities at their command.

The Work of the Electricity Commissioners.

The report of the Electricity Commissioners for 1923-24, of which an abstract is commenced on another page, furnishes gratifying evidence of the development of electricity supply, the sale of energy during 1923 having increased by 19 per cent.; at this rate, the output will be more than doubled every four years. The consumption averaged over the whole of Great Britain was about 100 kWh per head, so far as authorised undertakings were concerned, but it is pointed out that this figure does not include the energy generated by traction authorities and non-statutory undertakings, amounting to 24 per cent. of the energy generated by authorised undertakers, nor does it take account of the very large output of private plant in factories and works, estimated by the Commissioners at not less than half the aggregate supply derived from public utility stations; hence the actual consumption is probably about 200 kWh per head per annum. According to the report of Mr. Lloyd George's Committee on "Coal and Power," in 1920 the output in the United States was 176 kWh per head, and in England only 60; the latter figure was evidently very much under-estimated, seeing that between 1920-21 and 1922-23 there was a net increase of only 11 per cent. in the case of public supply stations. Even if we suppose the United States consumption to have doubled in the interval, the ratio is not 3 to 1, but more like 1¾ to 1.

Reviewing the progress of the past four years, the Commissioners point out that only by the establishment of a central body, such as a Joint Electricity Authority, endowed with adequate powers, can a comprehensive scheme of development for a large district be carried out; unfortunately the majority of authorised undertakers are reluctant to transfer their stations to such an Authority, and they prefer advisory bodies to Joint Electricity Authorities, the results falling short of those anticipated in 1919. The Commissioners pin their faith to central ownership, and show how little can be done under the existing conditions; with regard to what has been accomplished, they express a feeling of disappointment, and call for "united effort and a willingness to pool resources for the common good." So long as the disposition to regard electrical development from a purely local point of view persists, they say, adequate reorganisation cannot be attained on the basis of existing legislation, and "failing the early disappearance of the obstacles which have hitherto retarded progress, the whole position will call for review." These are ominous words. It is quite clear that the Commissioners feel that their hands are tied, and that further powers are essential to the achievement of their aims; for it cannot be hoped that the parochial feeling which they deplore will be overcome by persuasion.

Electricity Supply at Torquay.

The Newton Abbot Generating Station.

THE Torquay Corporation commenced to supply electricity within the borough in March, 1898, the system being single-phase at 50 periods, with primary distribution at 2,000 volts, consumers being supplied at 200 volts from street transformers. The station was extended in 1902, and in 1906 the advent of the Torquay Tramway Co., Ltd., necessitated the provision of d.c. plant. In 1911 further extensions took place, the first turbo-driven set being introduced; a second set was added in 1913, being wound for three-phase, 2,000 volts in anticipation of removal to the new site, and was of 1,250 kW capacity. In the following year an additional 1,250 kW turbo-alternator was ordered from the B.T-H. Co., but the war intervened before it was delivered, and further development had to be held in abeyance until 1919.

Meanwhile it had become desirable to remove the station from the sea-front, but from the outset the choice of a suitable site had presented formidable difficulties on account of the peculiar configuration of the town. Therefore, attention was directed beyond its boundaries and a site upon the River Teign, adjacent to the Great Western Railway at Newton Abbot, was eventually selected as affording the requisite facilities, and being situated suitably for the distribution of energy to neighbouring townships as well as to Torquay.

Newton Abbot was then supplied with electricity from a d.c. 520-kW station, owned by the Urban Electric Supply Co., Ltd., and situated close to the site selected. The Newton Abbot load is chiefly industrial, while that at Torquay is residential in character, and the advantages to be gained by the combination of the loads being obvious, the Newton Abbot Urban District Council exercised its option to purchase the company's undertaking and then transferred it to Torquay Corporation. Power to effect the transfer and to raise the necessary capital was obtained by the Torquay Corporation (Electricity) Act, 1922, by which also the Torquay area of supply was extended to include the Urban District of Newton Abbot and intervening parishes. Owing to unavoidable causes, the erection of generating plant was not commenced until March, 1924. Simultaneously the receiving sub-station and new general offices were built at Torquay, the underground trunk mains were laid during the summer of 1923, and numerous new 2,000-volt mains in Torquay (necessitated by the change of site and also of the supply from single- to two-phase) were laid early in 1923.

Newton Abbot power station now contains generating plant of some 6,000 kW total capacity. The company's old buildings, with but slight modification, have been used to house the two 1,250-kW turbo-alternators which have been transferred from Torquay. A d.c. Bellis-Siemens reciprocating set has also been transferred for providing an independent supply for the works power in conjunction with the company's 600-Ah D.P. battery, and also to facilitate the reconstruction of the station.

The company's four Babcock & Wilcox boilers, totalling 25,000 lb. per hour, actual, normal evaporation, have been retained *in situ*, and a new stack with induced-draught plant installed in connection with them, together with a recently constructed Green economiser, transferred from Torquay. Apart from these boilers and the battery, all the original plant has been removed, while the the original office buildings have been slightly extended to accommodate the meter and electrical test rooms, and the fuel, oil, and water testing laboratory.

The whole of the new boiler-house plant was supplied by the Stirling Boiler Co., Ltd., and comprises two boilers of the five-drum type, the heating surface of each unit being 5,546 sq. ft., each capable of evaporating 25,000 lb. of water per hour, with feed water entering the economiser at 100 deg. F., into steam at 165 lb. per sq. in., superheated 170 deg. F. to a final temperature of 543 deg. F. The boilers are arranged as single units, each fitted with a pair of Babcock & Wilcox chain-grate inclined stokers, the total area being 144 sq. ft., with special narrow lap links for burning Yorkshire or Welsh fuels.

The superheaters are of the Stirling "U"-inverted type, and the economisers are of Messrs. Green's manufacture. Two "Sirocco" fans are coupled direct to the main flue, and each is driven by an enclosed ventilated shunt-wound B.T.-H. motor of 36 b.h.p. The fuel is delivered into a hopper outside, whence it is lifted into the overhead bunkers by an inclined chain and bucket elevator, operated by a 3-h.p. totally-enclosed compound-wound B.T.-H. motor with a Brookhirst starter. The turbine feed pumps were supplied by Messrs. J. and G. Weir, Ltd., and the working steam pressure and temperature were selected to save capital charges by enabling the old Torquay generators and the Newton Abbot boilers to be utilised.

A new turbo-alternator, supplied by the British Thomson-Houston Co., Ltd., is rated at 3,000 kW, 90 per cent. power factor, 3,000 r.p.m., and is suitable for an 11,000-volt, 50-cycle, 3-phase system. The turbine is of the 9-stage combined impulse type, exhausting in a 28½-in. vacuum and consuming 12.89 lb. of steam per kWh at full load. The alternator is totally enclosed, and the cooling air is drawn in by a rotor fan through a Grice washing filter.

The condenser cooling water is drawn from the River Teign. The design of the circulating system presented considerable difficulty on account of the great seasonal variation of the depth of water in the river (amounting to as much as 20 ft.), and also to the intervention of the confluent River Lemon between the main river and the power station. Barge traffic in the Lemon necessitated the sinking of the circulating-water pipes, which are buried solid in concrete under the river bed, and in order to meet the requirements of the Teign Conservators also, it was necessary to return the circulating water directly to the Teign instead of *via* the Lemon, thus involving a double crossing of the latter river.

The surface condensing plant, which will maintain a vacuum of 28½ in. when dealing with 48,000 lb. of steam per hour with cooling water at 60 deg. F., is of the Cole, Marchent & Morley type; the cooling surface is 4,500 sq. ft., and the equipment includes a two-stage Delas steam-operated air extractor with a vacuum sealing box designed to deal with 30 lb. of dry air per hour. The steam used is recovered in heating the feed water.

The river water is passed through double screens at the intake, and in the pump house basement are installed three vertical-spindle centrifugal pumps of Messrs. Mather & Platt's Lonovane pattern. They are so installed as to be 3 ft. below the deepest part of the river bed, so ensuring a pressure head upon them at all states of flood and tide. Each is driven by a 40-h.p. variable-speed d.c. motor approximately 20 ft. above the basement floor, and will deliver 150,000 gallons per hour against a head of 30 ft. The circulating water system operates as a closed siphon, and the motors are automatically controlled from the power station switchboard.

For converting a.c. for the Newton Abbot town supply and for the works power, two B.T.-H. 400-kW, compound-wound, self-synchronising rotary converters have been installed in conjunction with two 440-kVA Brush transformers. One of the converters can be "inverted" on occasion; normally they are operated from the

10,750-volt, 50-cycle, three-phase supply, and give a d.c. pressure of 500 volts between outers with a mid-wire connection, the voltage balance being automatic. There has also been installed in the new sub-station at Torquay a 300-kW, compound-wound, two-wire, self-synchronising rotary converter operating with a 330-kVA, 10,500-volt transformer, and capable of running in parallel with the 500- and 300-kW converters originally installed at the old Beacon Quay station. New transformers have rendered them suitable for the new conditions. The transformers are of the oil-immersed, self-cooled core type, the primary windings having tappings at plus and minus 2½ per cent. and 5 per cent. The secondary windings give a six-phase supply for the sliprings of the converters, mid-wire tappings being provided for the Newton Abbot three-wire supply.

The e.h.p. switchgear was manufactured by the British Thomson-Houston Co., Ltd., and is mounted in moulded-stone cubicles on the engine-room floor, and the oil circuit breakers are electrically operated from a vertical board on the gallery above.

The d.c. switchboard is also of the B.T.-H. type, and the 11,000-volt switchgear at the Torquay main sub-station is of the B.T.-H. compound filled draw-out truck type. It comprises 10 panels which control the two incoming feeders from the Newton Abbot power station, three rotary converters, one bus-section, and four step-down transformer banks, which are Scott connected to supply the 2,200-volt switchboard and the Torquay single-phase systems.

The 2,200-volt, two-phase and single-phase switchboard at the sub-station is a moulded stone cellular structure There are fourteen equipments in all controlling the secondary side of the four Scott-connected transformer banks and the ten single-phase feeders. The oil circuit breakers are remote mechanically operated from a board directly in front of the cells. The d.c. switchboard is of a similar type to that at the power station.

Two 11,000-V, 3-phase, 50-cycle cables link the power station to the sub-station at Torquay. They were supplied by the British Insulated & Helsby Cables, Ltd.

Halfway between Newton Abbot and Torquay the 11,000-volt mains are brought into a sub-station which, in addition to being a switching point, also contains the 3/2-phase transformers, made by the British Electric Transformer Co., Ltd., which supply Kingskerswell, Abbotskerswell, and the rural districts.

Agreements have already been completed by which the Newton Abbot station will, before next winter, give a supply to Teignmouth, Shaldon, Bishopsteignton, Kingsteignton, and other districts on the north side of the Teign, and it is anticipated that in the near future the area served by the new station will be considerably extended.

It is satisfactory to be able to record that the reconstruction and transfer of plant was completed without any hitch or irregularity of supply in either town. The whole scheme was initiated by and carried out in accordance with plans and specifications prepared by Mr. H. F. G. Woods, M.I.E.E., A.M.I.Mech.E., borough electrical engineer, for a total cost of £170,578, from which sum must be deducted £3,020 realised by the sale of old plant. The official inaugural ceremony was performed on September 16th by Sir John Snell, chairman of the Electricity Commission.

Electricity Supply at Brighton.

Inauguration of Recent Extensions.

THE County Borough of Brighton's public electricity supply service is one of the oldest in the United Kingdom. The present station at Southwick, on an arm of Shoreham Harbour, was completed in 1905. As the plant became obsolete, the turbo-alternators were, one at a time, replaced by modern machines of double the capacity at about half the steam consumption, fig. 1, with the result that each of the boilers was capable of steaming 1,500 instead of 600 kW as formerly, and no extension of the boiler house has been necessary until now.

The most recent extension of the generating station and the Kemp Town sub-station was inaugurated on September 10th by the Mayoress, Mrs. H. Milner-Black. The new Metropolitan - Vickers turbo-alternator, fig. 2, generates 6,000 kW at 8,000 volts, 3-phase, 50 periods, 3,000 r.p.m., and the condenser has 12,000 sq. ft. of cooling surface, and is fitted with the Cumberland electrolytic process for the prevention of tube pitting.

A gear-driven Allen d.c. service turbo-generator, fig. 3, of 400-500 kW capacity, with steam-driven auxiliaries, has also been provided to maintain a supply in emergency for operating the auxiliary plant in the station. The extension includes two Yarrow marine-type boilers, fig. 4, one of which is oil fired, the other coal fired by means of the Underfeed Stoker Co's. travelling grates fitted with "Radex" caps and a "Detrick" arch, and using pre-heated air. No economisers are fitted to these boilers, the normal rate of evaporation of each of which is 40,000 lb. per hour at a pressure of 250 lb., superheated to 600 deg. F.

Three of the nine original Babcock boilers and one of the two new Yarrow boilers are equipped for oil fuel firing on the Wallsend Slipway Co's. pressure-jet system. The oil storage tanks of 1,000 tons capacity can be filled from oil tank steamers of 500 tons capacity, which can be discharged at the rate of 150 tons per hour.

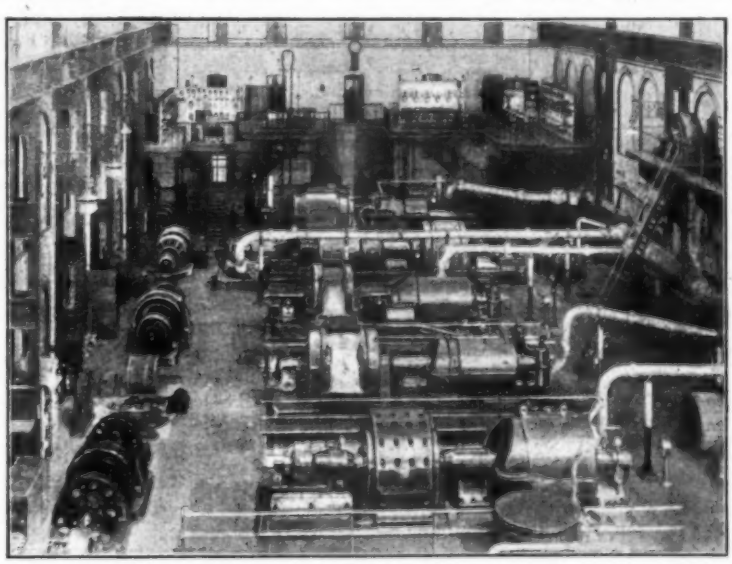


Fig 1.—Turbine Room at Brighton, 20,000 kW Capacity.

Storage accommodation is provided for 5,000 tons of

coal, and suction plant has been installed by Messrs. H. J. H. King & Co., Ltd., for conveying the coal from ships to the reserve stock, from the latter to service bunkers, or from ships direct to service bunkers.

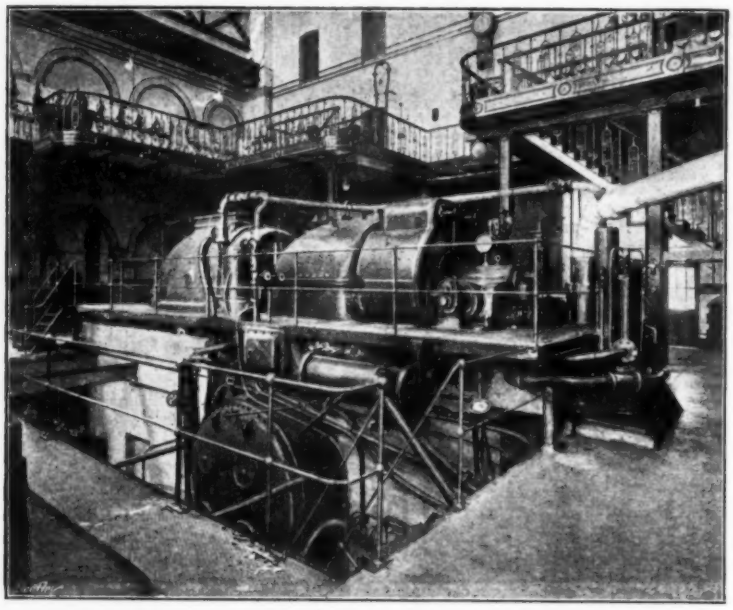


Fig. 2.—New 6,000-kW Metropolitan-Vickers Set.

The condenser circulating water pump was supplied by Messrs. Gwynnes, Ltd., and the e.h.p. switchgear is of the Metropolitan-Vickers pattern.

The old North Road station is now used as the main sub-station (12,000 kW capacity) for supplying the centre of the town. It is interlinked to the Southwick power station by five e.h.p. trunk feeders, each of .25 sq. in section, 3,000 kW loading per feeder, or 15,000 kW total capacity. The feeders have been in continuous service for almost 20 years, and during that lengthy period no mishap of any sort has taken place, and recent tests show that it may be possible later on, if necessary, to treble the capacity of each of them by raising the pressure to 24,000 volts.

From this central sub-station h.p. mains radiate to three smaller sub-stations, that at Kemp Town being complete and the other two in course of construction. Rotary converting plant is being provided for dealing with the direct-current requirements of the areas which they serve. It is intended further to extend sub-high-

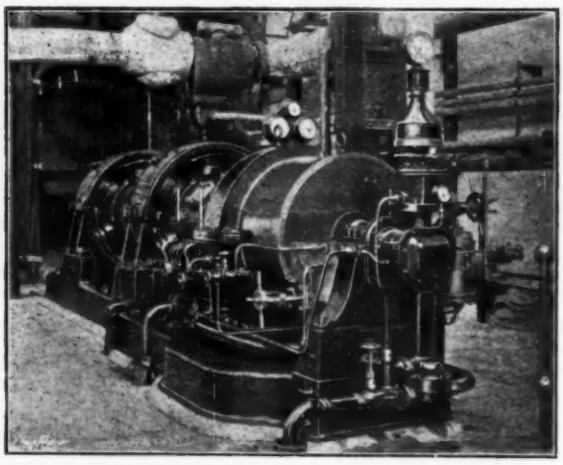


Fig. 3.—Allen House Service Turbine Set.

pressure feeders from the three sub-stations to afford a 3-phase 4-wire a.c. supply to a new distribution network through static transformers. Provision is made at the sub-stations for housing 8,000-24,000-volt step up outdoor transformers to supply the outlying areas as the demand arises.

The Kemp Town sub-station is somewhat unique in that it is not only automatic, but at will also remotely controlled by means of pilot wires from the main sub-station at North Road. The plant consists of a Bruce-Peebles-La Cour converter of 500 kW capacity, with Reyrolle h.p. a.c., automatic, and remote control switchgear and Bertram Thomas d.c. switchgear. An order to duplicate this plant has now been placed, and a h.p. feeder from this sub-station is being extended to take over the supply at Rottingdean Village, some 2½ miles further east, and to operate a large pumping plant at the main sewer outfall at Portobello, a mile and a half beyond, for accelerating the flow and thus indefinitely deferring the necessity for enlarging it.

The extra-high-pressure cables were supplied by Messrs. Siemens Bros. and Co., Ltd.

A new scheme is in progress for bringing the public lighting system up to date. The first section on the King's Road Front has been in service since July, 1923, and is considered a good example of promenade lighting. The pillars with canopy tops have been equipped with large panelled basket-shaped lanterns, each fitted with 1,500-watt gasfilled lamps, and run in series of 5 and 10 off the lighting network with a substitutional resistance and automatic cut-out in parallel with each lamp.

Further lighting with the "Oxford Street" and "Wembley" types of lanterns with 500- and 1,000-

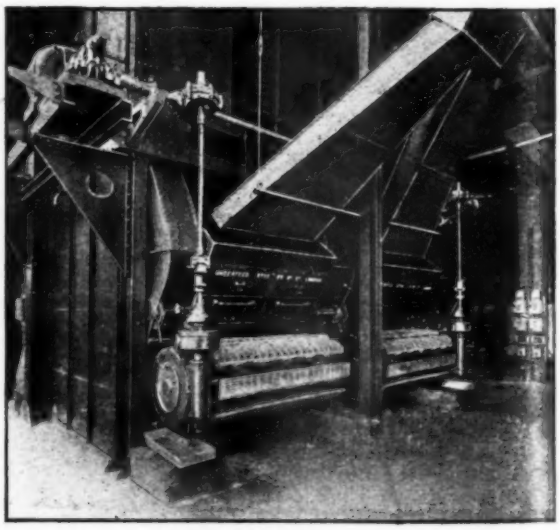


Fig. 4.—A Yarrow Boiler.

watt gasfilled lamps, also run in series, is being gradually carried out in other less important sections of the town. A new scheme of lighting has also been installed in the Valley Gardens, modelled on the "White Way" system which has been so largely adopted in America.

The street and sub-station lighting equipment was supplied by the Electric Street Lighting Apparatus Co.

The undertaking has 11,500 consumers and a revenue of £185,016. During the last financial year 15,666,907 kWh were sold, and no less than 57 per cent. of the capital expenditure has been written off. Since its inception it has contributed £62,785 towards the relief of the rates, which figures indicate that the rate of progress under the guidance of Mr. John Christie, M.I.E.E., the engineer and manager, has been most satisfactory.

The British Association Meeting in Canada.

(By Our Special Correspondent.)

THE spacious and beautiful grounds of the University of Toronto, and its numerous buildings, were for a week the scene of great bustle and excitement as the locus of the British Association meeting.

There is no doubt that the visitors from overseas have had a good time and have been greatly impressed by what they have seen in Quebec and Ontario. Even those who have been in Canada before have noted great progress in industry generally and in the achievements in civil, mining, railway, electrical, and other branches of engineering.

Those familiar with meetings of the British Association will be well aware how impossible it is for any one person to listen to more than a comparatively small portion of the papers presented. Four times has the Association visited Canada, *viz.*: Montreal, 1884, Toronto, 1897, Winnipeg, 1909, and now again Toronto.

The meeting of the British Association now under review commenced on the evening of August 6th with the address by the president, Sir David Bruce, his subject being "The Prevention of Disease." Not very much of it was of direct interest to readers of the ELECTRICAL REVIEW as such, but it had a very powerful human interest for everyone.

The speaker quoted the English Minister of Health as saying, some little time ago, that "upwards of 20,000,000 weeks of work were lost every year through sickness among insured workers in England." In other words, the equivalent of the work of "375,000 people for the whole year had been lost to the State," and that by insured workers only. The direct loss in England and Wales, it has lately been calculated, from sickness and disability, amounts to at least £150,000,000 per year. In the United States it is put down at £600,000,000.

Before passing to the subject of papers presented before individual sections of the British Association, it is worth recording that, although the number of papers read each day was very large, the attendance, in all cases which came under the observation of the writer, was very good indeed, and in many instances was very large. The British Association may congratulate itself on having attracted the attention of very many Canadians, a good proportion of them being ladies.

Section A.—Mathematical and Physical Science.

A very interesting paper was read by Dr. J. S. Owens on "The Automatic Measurement of Atmospheric Pollution." The instruments devised by the author for this purpose have been described in the Third and Fourth Reports of the Advisory Committee on Atmospheric Pollution. At regular intervals throughout the 24 hours, two litres of air are aspirated through thick filter paper on a very small area (a circle $\frac{1}{8}$ in. in diameter), and the blackness of the deposit left on the paper is compared with a special scale of shades. Records of this kind have been taken in various cities over long periods, and curves have been made of the results. The curves indicate quite clearly the existence of peaks (*i.e.*, increased pollution) at certain hours of the day and on certain days of the week; as might be expected, the clearest air is found in the night and at the week-end.

Sir William Bragg gave a lecture on "The Analysis of Crystal Structure by X Rays," indicating in a very clear and simple manner how much it has been possible to learn from this method regarding the structure of crystals. The lecture was one of that class in which engineers are not directly interested, but since it dealt with researches into the structure of matter, there is no knowing how soon discoveries may be made which will one day profoundly affect engineering practice. There is no more useful tool in the hands of the research worker than electricity in one or other of its manifestations, and Sir William Bragg tells us that the number of molecules in the crystal cell and the mode of their arrangement, with such determination of lengths and angles as are required to define the mode of arrangement in full, are ascertainable by means of X rays which have provided an unexpected and welcome entrance into an immense field of research. It is hoped in the end to determine the position of every atom in the crystal unit and explain its influence, through its nature and position, upon the properties of the substance.

Comment on the value of such research is needless; its possibilities of application to the needs of all branches of engineering cannot at present be adequately conceived.

Section B.—Chemistry.

Electrical energy from Niagara Falls is utilised by the Canadian Salt Co. at Windsor, Ontario, which is 240 miles from Niagara. Mr. D. A. Pritchard, of the Canadian Salt Co., described the "Gibbs" cell and the manufacture of liquid chlorine. Soap and paper industries take the alkali produced, while the chlorine goes to make bleaching agents, and is used extensively for the purification of municipal water supplies.

In a general discussion by several members on "Canadian Electro-Chemical Industries," Mr. Fitzgerald, in describing an electric resistor furnace designed by himself, stated that graphite or carbon plates set between carbon blocks were used, and that regulation was effected by varying the pressure on the plates. Temperatures up to 1,800 deg. C. were obtainable, and after much trouble had been experienced with refractories, he found that recrystallised carborundum was the only material which gave satisfaction. Even special bricks of other refractories were completely melted at the temperatures attained in these furnaces. Mr. Fitzgerald announced that a furnace for porcelain work had been perfected after many trials within the last six weeks, and that ceramic work could now be properly taken care of.

This paper was one of several short ones of a like nature which were followed by discussion, during the course of which one speaker stated that electric boilers are now being made in sizes up to 25,000 kW, and that the cost ranges from $2 to $1 per kW. In order to give an idea of the small space taken up by such boilers, he said that a boiler 6 ft. long by 12 in. in diameter, weighing about 100 lb., could be used for a power input as high as 500 kW.

As a result of a paper read by Col. H. D. Savage, of the Combustion Engineering Corporation, which dealt with the use of pulverised coal on locomotives, there was some very interesting discussion.

Prof. Bone said that a friend of his in the United States, who was in a good position to know the facts, had given him some most discouraging reports about two years ago as to the use of pulverised fuel, and he was consequently not at all convinced as to the real success of pulverised fuel under stationary boilers. He considered that the action on brickwork was a very serious item, and that there were still many difficulties to be overcome, although he admitted that the system was satisfactory as far as steam-raising was concerned.

Dr. Miller, of the Toronto University, believed that plant in France was giving satisfaction, and considered that the trouble experienced at one plant in England where pulverised fuel had been a failure was probably due to ash from the kind of coal used. He thought that the refractories should be coaled artificially, as is now being done in some of the latest cases.

Another speaker said he had reason to think that

the troubles with firebricks had been surmounted. He went on to point out that, whereas in some quarters it was being urged that low-grade fuels could be utilised extensively if used in pulverised form, it must be remembered that it would not pay to transport such fuels very far from their source.

Col. Savage stated that the cost of boiler brickwork for a powdered fuel plant was lower than for mechanical stokers.

Whatever status pulverised fuel has reached in England, there is no doubt that it has made much headway in the United States, and some of the very largest and most modern stations are being equipped to burn coal in this form.

Prof. Bone lectured on "Brown Coals and Lignites," a subject which is of great importance to the Dominion on account of the enormous deposits of lignites found in Western Canada. He considered that there was great need for definite co-operation between the various parts of the Empire so that facts and theories regarding these fuels might be interchanged; comparatively little was known about them, and the subject was a very complex one. A good deal of work had been done in London, but it was not a problem to be worked out in Great Britain alone.

Section G.—Engineering.

Prof. Howe, the President of this Section, gave a very interesting address on "One Hundred Years of Electrical Engineering," in which he showed the immense progress that has been made in that comparatively short period of time. It was amusing to be informed that Thomson (Lord Kelvin) once referred to the commutator as a "great evil" and a "frightful thing," especially as he afterwards became one of the strongest advocates of direct current. In pointing out the very low efficiency of transformation of the heat energy of coal to the useful light energy of the incandescent electric lamp, the lecturer stated that "even now, with up-to-date steam plants and gas-filled lamps, not more than 40 to 60 lb. of coal out of each ton is useful in producing light"; he added, however, that "electrical engineers may derive a little comfort from the knowledge that the purely electrical links are the most efficient in the chain." It was interesting to note how much of the progress in electrical engineering had been made within the memory of the older men who heard this address.

Mr. A. V. White, of the Hydro-Electric Power Commission of Ontario, read a very interesting paper prepared by Dr. F. A. Gaby, who, unfortunately, was in England at the time. This paper, which was illustrated by many lantern slides showing the Commission's great undertakings, presented a general survey of the Commission's work and policies, with which readers of the ELECTRICAL REVIEW must by now be fairly familiar.

Mr. R. S. Lea, a consulting engineer of Montreal, presented a paper on "St. Lawrence Power and Navigation Development." After briefly referring to the main geographical features of Eastern Canada, the speaker described the chief characteristics of the St. Lawrence River. Power to the extent of about 350,000 h.p. has already been developed on the St. Lawrence River partly in a small way in connection with the canals, which enable boats to go around the rapids, but mainly three or four stations which derive their power from the diversion for themselves of a portion of the flow of the river. The Cedar Rapids plant has a capacity of 200,000 h.p. under a 30-ft. head, there being 18 sets of nearly 11,000 h.p. each. Several schemes for developing all available power on the St. Lawrence have been proposed either by private interests or under Government auspices. These works in either case would be of exceptional magnitude and importance, and include not only power development, but navigation requirements as well. The minimum ultimate depth proposed for the locks and navigation channels is 30 ft., which will permit ocean-going steamers to come through, and the total power when fully developed will amount to from four to five million horse power, with individual stations having capacities of from 600,000 to 1,500,000 h.p.; about four-fifths of the total power available belongs to Canada. The average recorded discharge of the river during nearly 65 years is about 247,000 cu. ft. per second, the lowest and highest rates of flow are about 193,000 and 320,000 cu. ft. per second. Such uniformity of flow is, of course, never even approached in any other river, and in this respect the St. Lawrence stands absolutely alone.

The Ottawa river has a high degree of natural regulation, yet its flow varies from 15,000 to 350,000 cu. ft. per second, while that of the Susquehanna, in Pennsylvania, which has great fluctuations of flow, varies from 2,400 to 550,000 cu. ft. per second.

In speaking of winter conditions, Mr. Lea stated that ice was the crux of the problem of power development and operation, especially where the flow of the whole river was involved. Several of the proposed schemes for the development of the St. Lawrence for both power and navigation were described in considerable detail.

Mr. J. B. Challies, director of the Dominion Water Power and Reclamation Service, was unable to be present to read his paper on "The Water Power Situation in Canada," and Mr. Norman Marr, of the Dominion Water Power Branch, read it instead.

As the title indicates, this paper was a general review of the vast water-power resources of the Dominion. Dealing first with the subject historically, it pointed out that, prior to 1895, water powers were developed almost exclusively for direct mechanical driving of saw mills, grist mills, paper mills, &c., on a small scale; at the end of 1895 the total development for the whole Dominion was not more than 75,000 h.p., very few places having electric power up to that date. By the end of 1910 hydro-electric power had been introduced into the principal cities, and the total water-power installation had grown to 880,000 h.p., and at the beginning of 1924 this figure had reached 3,227,000 h.p. While in the last decade Canada's population increased 22 per cent., the water power developed increased nearly 100 per cent., the use of water power in industry 245 per cent., and the capital invested in manufacturing industries 175 per cent. The capital invested in water-power development, including transmission and distribution, amounts to about $688,000,000.

Outside of general industrial requirements for electric power, the manufacture of pulp and paper, and mining, are the industries which are of prime importance in the use of water power. In pulp and paper mills, of 497,620 h.p. actually installed, about 439,000 h.p. is hydro-electric. In the mining industry over 100,000 h.p. of hydro-electric power is employed in the metalliferous mines of Northern Ontario, and new water-power sites are being rapidly developed. Even coal mines use hydro-electric energy where possible. A series of interesting lantern slides beginning with photographs of hydro-electric developments in British Columbia carried the audience across the entire Dominion from the Pacific to the Atlantic, noting all the large power developments on the way.

In a paper by Prof. Coker, which was read by Mr. Kimball, on "Optical Determination of Stress," very interesting colour-photographs of celluloid test bars under stress were shown. Transparent celluloid is used and polarised light is passed through it, this giving gradations of colour, which are an indication of the relative amount of stress imposed on each part of the celluloid test bar.

As a result of researches made by this method, new shapes of test bars have been recommended. These investigations have shown that in compression tests, if the test block be compressed between blocks of a size larger than the cross-section of the test piece, the stress distribution is a complex one, but if at each end of the test piece extra blocks of metal be inserted between the test piece and the jaw of the compression machine practically pure compression is obtained. This was one of several very interesting papers preceding a joint discussion between Sections A (physics) and G (engineering) on "Optical Determination of Stress."

Section F.—Economic Science and Statistics.

Most of the papers presented before this Section were on subjects of no particular interest to engineers, but, in a lecture on "Business Forecasting," by Prof. W. N. Persons, a curve indicating world trade conditions between the years 1858 and 1909 showed that there had been seven peaks of prosperity, and seven valleys of depression. The lecturer stated that the most that could be learned from the curve as yet was that such periods did follow one another in direct succession, and it was hoped that further researches would enable the business world to stabilise itself by realising that no booms would last very long and, therefore, undue optimism was out of place, but, on the other hand, periods of depression were equally certain to come to an end and pessimism was unwarranted. The reasons for these fluctuations were not as yet known; they were irregular and could not be forecast. In the curve drawn by Prof. Persons, the crests of the various waves were separated by periods of 4, 6, 11, 7, 8, 10 and 5 years in the order given. The good and bad periods did not seem to be directly traceable to harvests or other conditions to which it would be natural to attribute them.

The speaker apparently considered that waves of thought permeating the community were at least partly responsible, and indicated this by drawing what looked like a three-phase alternating-current curve in which phase A represented the world of speculation, which was the first to be affected, phase B was the price of commodities, and phase C the price of money.

Various other lectures were given at the Toronto meeting of the British Association, but enough has been said to indicate that they were of an extremely interesting character, and to show what a healthy exchange of ideas was effected. Canadians learned a great deal of the latest achievements of research work, while the visitors from overseas, through lectures and through visits to paper mills, power plants, mining districts, lumber camps, &c., were given an opportunity of seeing how far this country has progressed in industrial development, and how vast are the resources for still further advancement. The memory of this meeting will live long with all those who had the privilege of attending it.

Wembley: Jottings from a Stand.

Now that we have passed well beyond the half-way stage of the British Empire Exhibition, the early impressions of a standholder have had time to settle into definite convictions.

Many pertinent questions arise, the chief of which is whether the Exhibition will pay the exhibitor. So far as those in the Palace of Engineering are concerned, and provided the question is limited to actual business done from the stands, the answer is a very definite negative. There are isolated instances of big orders having been booked by certain firms, but those fortunate exhibitors form a very small minority.

This fact is, however, not necessarily disturbing, as it is probable that most of the firms which took space did not expect to cover their expenses from orders actually booked during the period of the Exhibition. Rather did they hope to get in touch with new potential buyers, and they will therefore cheerfully allocate the apparent loss to advertising account.

If, then, we examine the question from this angle, the result is better.

Many inquiries have been made by Colonial and even Continental and American buyers, who have examined the plant displayed very keenly and expressed the hope of future business relations. In passing, it may be mentioned that the exhibitor has often been pleased to hear visitors from the Colonies comment on the high quality and finish shown, and add that although it is obvious the home manufacturer is doing his utmost to meet foreign competition, he is still out to maintain the good old British standard of a sound job and not to design or produce down to a price.

Potential results, so far as they refer to export business, may therefore be judged as fair, but when the home buyer is considered, a very peculiar fact is brought to light.

Factory owners and other direct users have, of course, made inquiries and placed orders, but the apathy of the English, and particularly the London, electrical contractor is amazing.

It must here be made clear that although these notes record the impressions of one standholder only, exhibitors are constantly comparing notes, and this apathy is a subject of general comment.

One would have thought that such a magnificent and representative display of electrical machinery and apparatus would have drawn all the trade.

The contractor is always loud and insistent in his claim that he is the only channel through which the manufacturer should reach the consumer. If this is so, surely he could benefit by examining the manufacturer's efforts.

Nothing stands still, and though a contractor may be perfectly satisfied with the manufacturers he already supports, it is conceivable that other makers are producing new goods, from the actual or potential demand for which the contractor's balance-sheet could profit.

It is sometimes suggested that contractors are waiting for the end of the school holidays and the slowing-down of provincial trips, when they can view the Exhibition more thoroughly and calmly. On the other hand, the remark has been heard that perhaps the contractor thinks he already knows everything and would be wasting his time at Wembley.

Whatever the reason, he has so far stayed away.

W.

An American Oil-Electric Locomotive.—A new type of oil-burning shunting electric locomotive has been built in the United States, and tested in the freight yards of the New York Central lines. This engine, which was built jointly by the General Electric Co. and the Ingersoll-Rand Co., resembles the conventional electric locomotive, but contains its own oil engine, electric power generator, and fuel tanks. The direct motive power consists of four G.E. motors, one of which is geared to each of the four axles. The locomotive has a total weight of 60 tons, all of which is available for adhesion. The engine is of the 6-cylinder type, and designed to burn fuel oil on the Price system, which avoids the use of high-pressure injection, and also effects a reduction in weight, an improvement in mechanical efficiency, and increased simplicity and reliability. The fuel is injected into the various cylinders through a distributor by means of a single-acting plunger pump. Water-cooling is applied to all parts of the cylinders and combustion chambers, the water passing to a radiator on the roof, whilst a thermostat maintains an even temperature. The exhaust box of the silencer is also on the roof. Sufficient fuel can be carried for 48 hours' continuous service. The engine consumes about 0.43 lb. of fuel oil per brake horsepower, and it is free from smoke.

The unusual feature is the direct-current generator supplying the motors without intervening accelerating resistances; a differential series field on the exciter automatically reduces the generator voltage with the increase in the amount of current drawn by the motor. The speed of the locomotive, therefore, automatically increases as the load is reduced, corresponding to the rise in impressed voltage. This control eliminates the possibility of overloading the generators or motors, or of pulling up the engine. The main excitation of the exciter field is furnished by a storage battery, which also supplies control current and that for the locomotive lights. In the tests made with the engine, the registered consumption was from sevenpence to eightpence worth of fuel per hour, about one-third of the amount used by steam locomotives. The engine is of 300 h.p. directly connected to a 200-kW G.E. generator supplying four 50-h.p. motors.—*Railway Gazette.*

The Costing of Winding and Insulating Coils.—On another page in this issue we bring to a close the series of articles on this subject that has been contributed specially to this REVIEW by Mr. F. C. Lawrence, of Messrs. Paton, Lawrence & Co., consulting cost accountants, of 11, Victoria Buildings, Manchester. It is generally recognised that there is a growing necessity for accurate costs, and we hope that this series of articles will be of interest and help to those engaged in the manufacture of coils and insulating materials.

E

Exports and Imports of Electrical Goods and Machinery in August, 1924.

THE decrease of £79,565 in the total value of exports as compared with July is probably a manifestation of the "holiday" influences which prevail at this time of the year. That the position is not so adverse as the first glance would suggest is indicated by the large increase in value which occurred as compared with August, 1923. A study of the individual items reveals that the decline in the exports of unenumerated electrical machinery was nearly equal to the net total reduction, but against this the increased values of exported telegraph and telephone cables, instruments, and apparatus amounted to over £80,000. The largest proportional decrease occurred in the case of railway and tramway motors, the exports of which were nearly halved. Insulated wires and cables also experienced a considerable fall.

The import total was increased as compared both with the July figure and that of the preceding August, the greatest actual augmentation in both respects being in the value of telegraph and telephone instruments. Proportionally the largest increase occurred in the item telegraph and telephone wires and cables. Carbons declined in value, as did unenumerated electrical machinery.

Re-exports as a whole were lower, this being accounted for mainly by the falls in the values of unenumerated electrical machinery and meters and instruments. The former item was the only one with a lower value than in August, 1923.

The eight-month totals, as will be seen from the last line of the table, showed an advance on the 1923 figures, the balance being well in favour of the exports.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Aug., 1924.	Inc. or dec. as compared with July, 1924.	Inc. or dec. as compared with Aug., 1923.	Electrical imports for Aug., 1924.	Inc. or dec. as compared with July, 1924.	Inc. or dec. as compared with Aug., 1923.	Electrical re-exports for Aug., 1924.	Inc. or dec. as compared with July, 1924.	Inc. or dec. as compared with Aug., 1923.
Electrical goods and apparatus (unenumerated)	£146,329	— £24,746	+ £83,531	£79,766	+ £374	+ £13,727	£4,744	— £166	+ £1,090
Insulated wires and cables ...	185,899	— 22,036	+ 74,230	35,963	+ 2,542	+ 11,117	398	+ 398	+ 188
Glow lamps	18,576	— 5,951	— 2,130	15,147	+ 2,398	+ 1,381	576	+ 500	+ 278
Arc lamps and parts	884	+ 323	+ 793	753	— 328	— 224	20	— 55	+ 20
Batteries and accumulators ...	56,304	+ 1,837	+ 24,335	23,462	+ 5,823	+ 10,984	238	+ 157	+ 194
Meters and instruments ...	33,743	— 7,632	+ 9,522	16,595	+ 2,979	+ 10,463	174	— 1,648	+ 19
Carbons	3,228	+ 1,362	— 240	3,555	— 7,315	— 7,619	125	— 149	+ 97
Electrical Machinery—									
Electrical machinery (unenumerated)	159,971	— 77,478	+ 66,749	81,038	— 8,959	+ 8,112	5,341	— 3,611	— 1,370
Railway and tramway motors	28,261	— 23,374	— 3,571	—	—	—	—	—	—
Other motors and generators ...	188,850	— 607	+ 77,800	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,020	— 1,652	+ 1,747	6	— 6	+ 6	7	+ 5	+ 7
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	112,175	+ 34,050	+ 71,262	14,010	+ 5,337	+ 8,510	260	+ 217	+ 260
Submarine telegraph and telephone cable	20,184	+ 2,154	— 200,373	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	229,874	+ 44,185	+ 124,986	54,282	+ 9,988	+ 27,064	3,652	— 110	+ 2,481
Totals...	£1,188,298	— £79,565	+ £328,641	£324,577	+ £12,833	+ £83,521	£15,535	— £4,462	+ £3,264
Increase or decrease for the eight months ended August, 1924 ...	Exports. + £1,861,731			Imports. + £441,224			Re-exports. + £7,899		

The Work of the Electricity Commissioners.

ANNUAL REPORT.

THE following is an abstract of the report of the Electricity Commissioners, for the year ended March 31st, 1924, which was issued last week.*

In their introductory remarks the Commissioners state that the period covered by the Report witnessed a further substantial improvement in the general output and financial position of electricity supply undertakings throughout the country, and was also noteworthy by reason of the coming into operation of several approved schemes for the improvement of the organisation for the supply of electricity in large districts.

The general reduction in the cost of generation and in the charges for electricity which was a marked feature of the preceding year was followed by further similar reductions in many parts of the country during the year 1923-24, with results beneficial to the supply undertakings themselves and also to industrial and domestic consumers generally.

While the progress made in cheapening the supply of electricity in many portions of Great Britain has been substantially aided by reductions in the cost of coal, plant and other materials, much has also been due to the efforts of those directly engaged in the technical and commercial development of the industry. The engineering experience gained during the war and subsequently, the steady improvement in steam-power station practice, the gradual displacement of older by more modern types of generating plant, the substantial addition made during the past four years of large modern units to the plant capacity of the country, and the increased attention devoted to publicity and propaganda have all contributed towards the lowering of the costs of production. Factors of the latter character may be expected to operate to an increased extent in the future.

The wider demand for supplies for all purposes during the year constitutes evidence of a sensible amelioration of the trade depression which has prevailed for the past three years, and from a broad review of the position, it can be said that the supply industry has substantially recovered from the reaction occasioned by adverse trade conditions. It is also of interest to record that in spite of the restricted industrial demand for power supplies and the retardation of the rate of growth caused by the general trade depression, the supply industry has contributed in an important measure to the provision of employment in allied trades, such as those engaged in the manufacture of electrical and steam-raising plant and accessories, and has thereby exerted a mitigating influence on the industrial situation.

The reasons for this are to be found in the great activity which has prevailed in the supply industry since 1920 and the volume of work occasioned by the overtaking of arrears of development caused by war-time restrictions and by the substantial programme of new construction put in hand by authorised undertakers during the past three years in anticipation of the additional requirements of the immediate future. Moreover, local developments have also been stimulated in many parts of the country by the operation of the later Electricity (Supply) Acts and by the steps which have been taken thereunder to bring about regional improvements in the present organisation for the supply of electricity. Such steps have been followed by numerous applications for further powers of supply, and the granting of powers has resulted in the initiation of many local schemes for the extension of supplies from existing undertakings into adjoining areas and for the establishment of new distributing undertakings in other urban and rural districts.

* H.M. Stationery Office, price 3s. net.

Authorised Undertakers.

On March 31st, 1924, the number of authorised undertakings in Great Britain was 560, of which 335 were local authorities and 225 were companies and persons. Though 57 Special Orders were approved during the year the figures show a net addition of 16 only to the number of authorised undertakers; this is accounted for by the numerous cases in which supply powers were granted to existing undertakers in respect of extended or new areas, by the transfer of undertakings which took place during the year, and by the revocation of a number of Orders and Special Acts which had been in force for some years but had not been put into operation.

Statistics given in the Report show that nearly 80 per cent. of the population is concentrated in areas aggregating 6,507 square miles, representing about 11 per cent. only of the total area of England and Wales, the average density of population throughout such portions of the country being 4,615 per square mile. About 20 per cent. of the population is sparsely distributed over the vast area comprised in rural districts, representing about 89 per cent. of the total area of the country and having an average density of population amounting only to 151 per square mile. These figures afford a clear indication of the governing factor in the problem of establishing remunerative supplies of electricity in rural districts of an average character.

General supplies of electricity are available throughout the whole of the Administrative County of London, in each of the 82 county boroughs in England and Wales, and in 175 (69 per cent.) of the municipal boroughs in England and Wales, the last-named having a total area of 882 square miles, and a total population of 4,236,338, representing an average density of population amounting to 4,803 per square mile. There remain 78 municipal boroughs in which general supplies are not available, comprising a total area of 378 square miles and a total population of 407,631, representing an average density of 1,078 per square mile; only eight of these boroughs have a population of 10,000 or over, and four of them are situated within the areas of supply of power companies.

General supplies are available or in process of being established in 448 (57 per cent.) of the urban districts in England and Wales, such districts having a total area of 2,330 square miles and a total population of 6,505,652, representing an average density of 2,792 per square mile.

The remaining 342 urban districts in which general supplies are not available comprise a total area of 1,800 square miles and a total population of 1,818,349, representing an average density of 1,010 per square mile. Of these districts, 42 have a population of 10,000 or over, and 22 are situated within the areas of supply of power companies.

Broadly speaking, not more than about 10 per cent. of the rural districts are *wholly* included in the areas of supply of undertakers authorised to give general supplies for all purposes, although in a number of other cases such districts are within the statutory limits of power companies; but there are numerous cases in which the more populous parishes, townships, and villages in the vicinity of urban centres form part of the area of supply of the undertakers operating in such centres.

It will thus be seen that general supplies are available or in process of establishment in areas in England and Wales having a population of the order of 28,000,000, or about 74 per cent. of the total. There are no fewer than 50 municipal boroughs and urban districts with populations of 10,000 or over in which general supplies have not yet been authorised. Many urban and rural communities in England and Wales, however, are being served at the present time by non-statutory undertakings.

Generation of Electricity.

The four-weekly returns rendered to the Commissioners show that about 3,500 million kWh were generated by local authorities (248 stations) and nearly 2,000 millions by companies (190 stations). In addition railway companies produced 572 millions (48 stations), tramway authorities 334 millions (27 stations), and non-statutory bodies 378 millions (28 stations), making a grand total of 6,681¼ millions (541 stations).

As compared with the previous year, the returns show an increase of about 16.4 per cent. in the number of kWh generated, and an increase in the consumption of coal and coke of about 11.2 per cent. The consumption of oil fuel also showed an increase from 60,054 tons to 73,139 tons, or nearly 22 per cent. About 44 million kWh, representing about 0.6 per cent. of the total, were generated by water power. The total consumption of coal and coke was 7¼ million tons.

About 94 per cent. of the total output is generated from coal and coke, and the relation between the percentage increase in kWh generated and fuel consumed shows that steady progress in the more economical utilisation of fuel is being made.

If the whole of the energy generated during the year under review had been produced at modern and efficient stations with an average consumption of, say, 2 lb. of coal per kWh generated, the total consumption of coal would have been of the order of 6,000,000 tons, representing a saving of some 20 per cent. on the actual consumption. These figures serve to emphasise the scope of the further economies open to be achieved by the centralisation of generation in the various electricity districts.

Of the 541 stations submitting returns, 224, or 41 per cent., generated less than 1,000,000 kWh each, while 398, or 73 per cent. of the stations, generated less than 10,000,000 kWh each. The extent to which the public supply of electricity in Great Britain is at present dependent upon a multiplicity of generating stations, mainly of small size, is forcibly illustrated by these figures, which are exclusive of the numerous non-statutory undertakings giving supplies in townships and villages in various portions of the country. A similar position obtains with regard to supplies used for manufacturing and industrial purposes, consequent upon the existence of a very large number of private generating plants of all sizes.

It is apparent that there is great scope for reorganisation on lines which will lead to the more economical production of electricity, by concentrating the generation in fewer well-placed interconnected stations and thus leading to the supersession of many of the small and uneconomical stations, both public and private, as cheaper and reliable supplies become available from such centralised systems. Since the establishment of the Commission local generation at 37 small stations has been entirely superseded by bulk supplies, and in upwards of 10 further cases similar stations have been relegated to the position of stand-by sources of supply only. This desirable process needs to be accelerated.

While it must be recognised that many of the small stations at present in operation are so isolated that there is no practical prospect of an alternative supply becoming available from a central system for many years to come, the developments now in progress in various parts of the country will undoubtedly result in the elimination of large numbers of small and uneconomical stations during the course of the next few years. Exception should be made, however, in the case of the small stations utilising water power, as these may be expected to continue in operation under any scheme of reorganisation. Moreover, the establishment of comprehensive transmission and distribution systems over wider areas than hitherto will undoubtedly lead to the development of further water powers at sites which are at present not sufficiently near centres of load to be of immediate practical utility, and also to the re-modelling of many small water-power sites which were formerly used for the development of industrial power but have since become disused.

Apart from the numerous water power plants which have been erected for private purposes and for the supply of electricity in villages and townships, of which complete records are not available to the Commissioners, only 27 of the undertakings here dealt with derived supplies from water power during the past year In eight cases the whole of the supply was obtained from water-power plant, and in the remaining cases partly from water-power and partly from fuel-power plant. The total capacity of the water-power plant belonging to or utilised by the undertakings in question was 13,825 kW, and in eight cases only was the capacity of the hydro-electric plant in excess of 100 kW. The largest water-power station owned by an authorised undertaker in Great Britain at the present time is that of the North Wales Power Company at Cwm Dyli, the installed capacity being 5,500 kW.

During recent Sessions, powers have been obtained from Parliament for three important hydro-electric developments in Scotland, namely, the Lochaber scheme, estimated to give an output of over 70,000 continuous h.p. at Fort William; the Grampian scheme, estimated to give an output of 56,000 continuous h.p.; and the Loch Doon development, estimated to give an output of 1,010 continuous h.p. During the present Session, a private Bill (the Lanarkshire Hydro-Electric Power Bill) was promoted for the purpose of securing the necessary powers to develop and utilise water power at the Falls of Clyde, estimated to give an output of from 6,500 kW to 13,000 kW at various times of the year (this received Royal Assent on August 7th).

Consumption of Electricity.

The returns of energy sold by authorised undertakers during the year show a total output of 2,758,954,180 kWh by local authorities and 1,579,896,746 by companies, an aggregate of 4,338,850,926, which is an increase of 19 per cent. on the previous year. The consumption per head of the population averages 100 kWh, but to this must be added the electricity generated by railway companies and tramway authorities and by non-statutory undertakings, amounting to 24 per cent. of the electricity generated by authorised undertakers; moreover, the output of private plant installed at collieries, iron and steel works, &c., is very great, the capacity of plant in some districts exceeding that of the whole of the authorised undertakers in those districts. From such data as are available, the Commissioners estimate that supplies from private plant probably represent at least half the total supply from all public utility stations, including those for traction, so that the consumption per head for all purposes in Great Britain at the present time may be regarded as of the order of 200 kWh per annum, or more.

(To be continued.)

Spanish Electric Locomotives.—It is reported from Bilbao that trials have taken place of the first electric locomotive constructed in Spain, which has been built by the Nervion workshops belonging to the Constructora Naval for the Northern of Spain Railway Company. Five other electric locomotives are being constructed in the same works for the Northern Railway Company.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Unskilled Use of Electricity in Hairdressing.

The vogue of permanent hair waving for ladies and the very inefficient and dangerous way in which the apparatus is operated by even first-class firms make it desirable in the public interest to utter a word of warning.

The waving machine consists in principle of a number of small electric curling irons which are interwoven with the hair, the latter being previously damped. If any of these curlers become defective, they may cause the person's head to come in contact with the electrical circuit and produce an unpleasant shock if another part of the body, such as the hand, is touching the washing basin, or other earthed object.

Should more than one curler be defective a shock might occur without the person touching any earthed apparatus, and this recently happened, to the writer's knowledge. In this case the shock caused the lady to jump forward, and in so doing she luckily pulled her hair clear of the curlers and saved herself from the probability of a very serious mishap.

The apparatus, by a few simple precautions, can be made perfectly safe electrically, and it would appear desirable that the authorities should issue instructions covering the use of this type of apparatus, both for the public safety and in the interest of the industry.

Such instructions could with advantage cover the use of electric hair driers and similar devices, in many cases without the slightest precaution, which might under certain conditions become a source of danger.

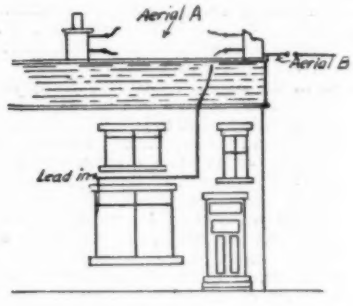
X.

September 8th, 1924.

Lightning and Radio Receivers.

A house at Shipley was struck in one of the recent storms, the double aerial destroyed, and the chimney stack demolished; another aerial fastened to the same stack was not injured. Referring to the accompanying sketch, it hardly seems possible that the path of the stroke was by the earthed wire, which was disconnected from the receiving set; the flash probably descended to earth by the rain water pipe. This example, which is the second I have noted, seems to contradict the popular opinion that there is no extra risk of damage to buildings through aerials. I also find that the devices for earthing at the instrument are often placed inside the room, forgetting that if lightning takes a roundabout path it will be out of control, so for safety there should be a direct circuit to earth outside the house.

It may interest your readers to know that the particulars of damage by lightning collected by a large number of observers, prior to the report of the Lightning Research Committee, have been handed by myself, as hon. secretary of the L.R.C., together with reports of societies in the United



States, Canada, and several foreign countries, also a number of Press cuttings, to the Library Committee of the I.E.E. The librarian will index and file them for general reference, and to help to continue the work I shall be pleased to receive any interesting reports of lightning damage, preferably to buildings with conductors or aerials.

Killingworth Hedges.

Westminster, *September 10th*, 1924.

Legal.

Unlawful Use of Electricity.

At Wallasey Police Court, on September 12th, Frederick Chaloner was fined 40s. for unlawfully connecting an electricity meter belonging to the Corporation. Defendant's electricity supply had been disconnected because of his failure to pay certain sums due. Some time after, a clerk from the borough treasurer's department of the Corporation noticed that electric light was being used on the premises. Upon inspection, it was found that the electricity department's seal had been broken and the fuses connected.

Defendant said that he had to have power, and he had paid for what he had used. He had paid about £9 instead of about £3.

Business Notes.

Bankruptcy Proceedings.—J. A. Bosher, electrical engineer and contractor, 7, Brondeg Terrace, and 33, High Street, Aberdare. Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff, appointed September 9th.

W. R. J. White, electrical agent, lately carrying on business at Golden House, 29, Great Pulteney Street, London. Last day for receipt of proofs for dividend October 1st. Trustee, Mr. V. Armstrong, Deputy Official Receiver, Carey Street, W.C.2.

R. L. Foggin, trading as the Tithebarn Radio Co. at Liverpool, and as the Crosby Radio Co. at Waterloo, electrical engineer.—First meeting September 23rd, at the offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination October 7th, at the Court House, Victoria Street, Liverpool.

Dissolutions of Partnership.—Humphreys & Sheffield, plumbers and electrical engineers, Rochdale.—Messrs. J. Humphreys and S. N. Sheffield have dissolved partnership. Mr. Humphreys will attend to debts and continue the business.

Turner & Walton, electrical engineers, Great Harwood, Lancs.—Messrs. P. C. Turner and W. P. Walton have dissolved partnership. Mr. Walton will attend to debts and continue the business.

Nicklin & Bryan, power engineers, Bath Street, Ilkeston.—Messrs. F. Nicklin and J. A. Bryan have dissolved partnership. Debts will be attended to by Mr. K. C. Horton, solicitor, Ilkeston.

Company Liquidations.—Kearney High Speed Railway Co., Ltd.—A winding up petition was presented on August 25th, and will be heard on October 14th. Solicitor to petitioner, Mr. H. V. Harraway, 12, South Square, Gray's Inn, W.C.

A. C. Alexandra & Co., Ltd., Iddesleigh House, Caxton Street, S.W.1, engineers, &c.—The statement of affairs shows liabilities £8,138, assets £1,163, and a total deficiency as regards shareholders of £17,087. The following are creditors:—

	£		£
A. C. Alexandra	702	Hay, Fielding & Co.	26
P. Adams, Ltd.	106	Howell & Co.	68
Bullers, Ltd.	24	A. de Jong	203
Burnley Components, Ltd. ...	186	Lithanode Co., Ltd.	117
Concordia Electric Wire Co. ...	82	Magic Appliances, Ltd.	60
Electrical Review	49	Macran, Ltd.	25
Electrician	58	Omega Lamp Works, Ltd. ...	496
Engineering, Ltd.	23	Pratt & Co.	41
Electro Dynamic Construction Co., Ltd.	28	H. W. Smith & Co. (1920), Ltd.	72
		A. Scott & Sons	53
Enfield Ediswan Cable Works, Ltd.	29	Temple Press, Ltd.	75
		Tollit & Harvey, Ltd.	30
Electric Auto Supplies, Ltd. ...	282	S. H. Taylor	40
Enterprise Manufacturing Co. ...	50	Visible Writing Machine ...	40
Falk, Stadelmann & Co., Ltd. ...	57	A. Vevy & Co., Ltd.	27
General Cable Manufacturing Co.	49	W. Whitehead	28
General Electric Co., Ltd. ...	211	Registrar of Joint Stock Cos. ...	100
Greenfield General Engineering Co., Ltd.	26	G. A. Spencer	30
		Fully-secured creditors	326
Hogan & Wardrop	61	Other liabilities	3,965
Hodge & Chilver, Ltd.	32	Preferential creditors	267

Morris & Lister, Ltd.—Particulars of claims to be sent to the liquidator, Mr. G. A. Lister, 82, Styvechale Avenue, Coventry, by October 11th.

Britannic Electrical Company, Ltd.—A meeting of members is called for October 10th at the offices of Messrs. Flint and Thompson, 71, Temple Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. G. W. L. Thompson.

Lincolnshire Motor & Electric Traction Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. G. Pearson, C.A., 1, Town Hall Street, Grimsby.

Private Arrangements.—F. C. Brown (Electricity) Ltd., Union Street, Coventry.—A meeting of the creditors of the above was held recently, when a statement of affairs was presented which showed liabilities of £912, all of which were due to trade creditors. On the basis of a going concern the assets were valued at £2,050 from which had to be deducted £409

due on debentures and £82 for preferential claims, leaving net assets of £1,558, or a surplus so far as the creditors were concerned of £646. It was pointed out that if a forced realisation took place the assets might not produce sufficient to pay the claims of the trade creditors in full. The business had been in existence for a number of years, and was taken over by the company in May, 1923. Only a few shares were issued for cash, the balance being allotted to Mr. Brown as the consideration for the purchase price of the business. The first year's trading showed a loss of £73, after allowing for the managing director's salary of £250. Last May debentures were created for £500, of which £400 were issued for cash. An offer was made of a composition of 10s. in the £ by four equal quarterly instalments, and a resolution was passed accepting the offer, providing it was guaranteed to the satisfaction of the three principal creditors, Messrs. Falk, Stadelmann and Co., the Metallic Seamless Tube Co., and the Cable Accessories Co.

Trade Announcements.—MR. S. T. PEMBERTON, 8, Church Street, Birmingham, who has represented Electromotors, Ltd., Openshaw, in the Midlands for direct current machines for 23 years, has now relinquished Messrs. Churton's representation in order to take over the representation of Electromotors, Ltd., for alternating current machines also.

The B.T.H. COMPANY has long realised the necessity of providing proper showroom facilities for the use of retailers and factors. It has already established showrooms in thirteen of the most important centres throughout the country. Hitherto, however, the South-West portion of England has not had its own B.T.H. branch, but has had to depend upon London. This omission was rectified by the opening on Monday, September 19th, of a branch depot at 119, Victoria Street, Bristol (Telephone: 6610 and 6611; Telegraphic address: "Asteroidal Bristol."). Complete stocks of lamps, lighting equipment, wiring supplies, and radio apparatus will be held at this new branch. The branch is in charge of the present local representative of the company—Mr. C. G. Rogers.

The address of HOPKINSON INDUCTION MOTORS is now Willesden Lane, North Acton, London, W.3. Telephone No.: "Chiswick 2763."

Catalogues and Lists.—THE SLOAN ELECTRICAL CO., LTD., 8, 10 and 12, Golden Lane, E.C.1.—A priced and illustrated catalogue of lighting fittings for various applications, including bowls, lanterns, electric signs, &c.

THE ARORA CO., Loughborough.—A new electric fire list, giving full details, illustrations, and prices.

THE LONDON FACTORS & AGENTS, LTD., 38 and 39, Parliament Street, S.W.1.—Price list of electrical accessories and materials, including heating, cooking, and lighting apparatus, &c.

MESSRS. ACKROYD & BEST, LTD., Beacon Works, Morley, near Leeds.—A well-illustrated catalogue of artistic glassware, including lighting bowls and shades.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—An illustrated and priced booklet dealing with frequency meters for switchboard installations.

MESSRS. VERITYS, LTD., Aston, Birmingham.—A comprehensive catalogue of "Maxlume" reflectors and lanterns. Illustrated and priced.

THE NEW PELAPONE ENGINE CO., LTD., Carr Bridge Works, Dewsbury, Yorks.—Booklet No. 146, containing particulars of the company's four-cycle paraffin engine driven generating sets.

MESSRS. HENRY JOSEPH & CO., LTD., 96 and 100, Victoria Street, S.W.1.—Price lists of electrical and radio materials and accessories, including cabinets and accumulator crates.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—An illustrated and priced catalogue of lanterns and reflectors, for industrial lighting.

MESSRS. BAGSHAWE & CO., LTD., Dunstable, Beds.—An illustrated leaflet advertising conveyors.

MESSRS. J. H. COLLIE & CO., 8, Harrington Street, Liverpool.—An illustrated pamphlet describing a gravity tester for small accumulators with three balls of varying specific gravities.

Local Exhibition.—ILKLEY.—During the week ended September 6th the Urban District Council arranged an electrical exhibition in the Winter Garden. Several local and national firms participated. The former included Mr. A. Innes and Messrs. Francis Law, Ltd. The Western Electric Co., Ltd., gave washing demonstrations, and the Hotpoint Electric Appliance Co., Ltd., provided a lady demonstrator to show the correct use of "Falco" electric cookers. Other exhibits were fires, water heaters, electrically-driven sewing machines, irons, &c. Mr. Edward J. Jarvis, the engineer and manager of the Council's electricity department, informs us that several cookers were booked for hire, and washing machines and vacuum cleaners were sold, as well as 18 fires. A number of new consumers were obtained.

Polish Electrical Trade.—The *Board of Trade Journal* states that the value of "instruments, conductors, and other electrotechnical apparatus" imported by Poland during March last was 2,679,000 zloty. (£1=23 zloty, approximately.)

British Guiana Electrical Trade.—From a list published in the *Board of Trade Journal* it appears that the imports of electrical apparatus into British Guiana increased from $6,017 in the first half of 1923, to $19,718 in the first six months of the current year. Machinery imports (unclassified) rose in value from $105,062 to $400,784.

German Porcelain Works.—The electrical porcelain industry in Germany is stated to have been confronted with great difficulties for many months past, as both the home and the foreign trade have considerably declined. Most of the works have been compelled to have recourse to restrictions in working and the reduction in the number of persons employed, and some of them have changed over to the production of other articles, while others are at a standstill.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the name and address of the British representatives are also given.

Ella. No. 449,550. Class 6. Electrical machinery and parts thereof; and No. 449,551. Class 13. Electric fusible cut-outs, electric ignition sparking plugs, electric lamps (ordinary), and electrical fittings.—Lionel Robinson & Co., 3, Staple Inn, London, W.C.1. September 3rd and 10th, 1924.

Carmenta. No. 449,661 and 449,662. All goods in Classes 6 and 13.—The Electrical Equipment & Carbon Co., Ltd., 109-111, New Oxford Street, London, W.C.1. September 10th, 1924.

Crystolia—Clear as Crystal (lettering and design). No. 449,402. Class 8. Combination gramophone and wireless receiving sets, &c.—John Holmes Holland, trading as J. H. Holland, 6, Arlington Road, Wallasey, Cheshire. September 10th, 1924.

Puriflex. No. 449,444. Class 8. Apparatus for use in wireless telegraphy and telephony.—Percy Wooton Harris, Devereux Buildings, Devereux Court, Strand, London, W.C.2. September 10th, 1924.

Yotto. No. 450,775. Class 8. Wireless telephonic and telegraphic apparatus.—The Wholesale Fittings Co., Ltd., Commercial Lamp Works, 23-27, Commercial Street, London, E.1. September 10th, 1924.

Tangent. No. 444,366. Class 13. Electric bells.—Gent and Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester. September 10th, 1924.

Irv-o-Slot. No. 445,844. Class 50. Electric insulation material, namely, flexible laminate sheet material made of textile fabric and fibrous paper with an intermediate layer of non-drying plastic compound having dielectric properties.—Irvington Varnish and Insulator Co., Irvington, N.J., U.S.A. (F. W. Golby, 3, John Street, Bedford Row, London, W.C.1.) September 10th, 1924.

Brownie. No. 446,245. Class 8. Apparatus and instruments for telegraphy and telephony, and detector crystals for use in telegraphy and telephony.—James William Barber, trading as the J.W.B. Wireless Co., 4, Park Crescent, Portland Place, London, W.1. September 3rd, 1924.

K.M.N. cables, wires, flexibles (lettering and design). No. 448,602. Class 8. Electric cables.—John Huston Stewart, trading as J. H. Stewart & Co., 1, Featherstone Buildings, High Holborn, London, W.C.1. September 3rd, 1924.

Markas. No. 449,604. Class 8. Receiving sets for use in radio telephony, and parts thereof.—Gordon Bros., 92, Market Street, Manchester. September 3rd, 1924.

Splendo. No. 450,829. Class 8. Radio telephonic and telegraphic apparatus.—The Wholesale Fittings Co., Ltd., Commercial Lamp Works, 23-27, Commercial Street, London, E.C. September 3rd, 1924.

Pattonite. No. 445,487. Class 50. Electrical insulating material, made chiefly of chemically laminated paper.—David John Patton, trading as David J. Patton, 43, Johnson Street, Westminster, S.W.1. September 3rd, 1924.

Social Events.—The annual special meeting of the travellers for Messrs. A. H. Hunt, Ltd., took place on September 5th. Lunch and supper were provided at the King's Arms Croydon, and in the evening the party attended the Grand Theatre. On the following day about 80 of the firm's employés proceeded by charabanc to Eastbourne, where, after lunch, the party amused itself in a variety of ways.

British Empire Exhibition Notes. — The Board of Directors has resolved to rescind Clause 29 of the General Regulations with regard to awards, and has adopted by way of substitution the following provisions:—(*a*) In the United Kingdom section a commemorative medal, accompanied by a decorative certificate, shall be awarded to each exhibitor who has rented space. Commissioners for India, the Dominions, Colonies, Protectorates, and Mandated Territories will receive a supply of identical medals and certificates for distribution amongst their exhibitors. (*b*) Exhibitors participating in collective exhibits of products or manufactures organised by the United Kingdom or Oversea Governments, or in art and scientific research exhibits organised by governments, associations, and committees, will receive a diploma of honour.

South African Government Supplies.—*The British and South African Export Gazette* says that after the present Parliamentary Session the Union Minister of Finance will go into the question of the purchase of Government supplies through local firms instead of the High Commissioner in London. Meanwhile, the preference of 5 per cent. given to South African merchants with regard to railway supplies is to be increased to 10 per cent.

Exhibitions in the Midlands.—As previously mentioned, the Shropshire, Worcestershire, & Staffordshire Electric Power Co. is running a series of exhibitions with a popular appeal at various towns in the Midlands. After an exhibition at Kidderminster, a successful week was concluded on September 6th at Dudley, and this is to be followed by similar displays at Smethwick, Redditch, Bromsgrove, Halesowen, &c. The Dudley demonstration was held in the local drill hall. The Western Electric Co., Ltd., showed kitchen appliances, including a dish washer, a clothes' washing machine, and irons. The "kitchen aids," exhibited by the Hobart Manufacturing Co., Ltd., included bread-mixing or pastry-making machines, a meat and fruit chopper, a vegetable and fruit slicer, and a coffee grinder. Messrs. Parnell & Sons demonstrated shop lighting. Other articles shown by this firm were coffee roasters, sausage makers, and universal cookers, &c. Service Signs and Advertisements, the representative of whom is Mr. G. W. Browne, of 14, Bourne Street, Dudley, demonstrated a new departure in electric flashing signs. Messrs. W. & T. Avery exhibited weighing machines of several types, and Singer's Sewing Machine Co. showed its products equipped with small electric motors. Callender's Cable and Construction Co., Ltd., demonstrated the ease of installation of the "Kaleeko" wiring system.

The Swiss Market for Wireless Apparatus.—A report on the market for wireless apparatus in Switzerland (Zurich district) has been prepared by the Department of Overseas Trade from information received from H.M. Consul-General at Zurich (Mr. L. E. Keyser).

Salesmanship Conferences in London.—The following is the programme of E.D.A. Salesmanship Conferences for the London area for the forthcoming session. It will be observed that the opening meeting takes place on Friday next, September 26th. It will be held at the E.L.M.A. Lighting Demonstration Department, 15, Savoy Street, Strand, W.C. All the other events will take place at the Caxton Hall, Caxton Street, Westminster. As we point out in our leader pages to-day, everybody electrical is invited to attend these meetings and to contribute to the discussions. There are no fees to be paid, and no tickets are necessary. One has simply to attend, to listen to the comments of the opener, and, if one feels able profitably to contribute to the discussions, to do so, however few may be the sentences and however faltering the speech, provided that he is able to say something worth saying and therefore worth listening to.

September 26th, 1924.—"A Programme for Intensive Lighting Development." Speaker: Mr. W. E. Bush (Electric Lamp Manufacturers' Association of Great Britain, Ltd.).

October 24th.—"Contracting for Pleasure and Profit." Speaker: Mr. H. Marryat (Marryat & Place).

November 28th.—"The Lost Opportunities of the Domestic Cookery Load." Speaker: Mr. S. C. Hurry (Jackson Electric Stove Co., Ltd.).

December 19th.—"Relation between the Sales Force, the Advertising and the Public." Speaker: Mr. V. W. Dale (British Electrical Development Association, Inc.).

January 16th, 1925.—"Electrical Work in the Retal Shop and Store." Speaker: Mr. E. E. Sharp (Venner Time Switches, Ltd.).

February 20th.—"Power and Heat in the Home." Speaker: Mr. C. E. Allsopp (Bradford Corporation Electricity Department).

March 13th.—"Development of Electricity Supply in Residential Areas." Speaker: Mr. R. Hardie (Glasgow Corporation Electricity Department).

New Italian Companies.—The Società Idroelettrica Alto Tanaro has been constituted at Genoa, with a capital of 1,000,000 lire for the building and operating of generating stations.

The Società Telefonica Piemontese (capital 1,000,000 lire), has been formed at Turin to take over telegraphs and telephones from the State.

At Rome the Società Anonima Radio Aralda has been registered with a capital of 1,000,000 lire, to carry out telephone, telegraphic, and radio undertakings.

For Sale.—By order of the George Cohen & Armstrong Disposal Corporation, Messrs. Fuller, Horsey, Sons & Cassell will sell on October 14th plant and machinery—including steam-raising and generating plant—at the Queensferry Government Factory. (See our advertisement pages to-day.)

Transformer Oil.—A transformer oil stated to comply in all respects with the B.E.S.A. Specification No. 148, Class A, has been put on the market by Shell-Mex, Ltd. It is a water-white hydrocarbon oil, supplied in new steel drums, and, according to tests by Messrs. Michie & Davidson, it has a flash point of 168 deg. C., specific gravity 0.8398, and a viscosity of 133 seconds (Redwood No. 1) at 15.5 deg. C. (B.E.S.A. maximum permitted, 175 seconds.) Sulphur, moisture, and acid are absent, and the sludge formation, after 45 hours at 150 deg. C. in presence of copper, is 0.008 per cent. (B.E.S.A. limit 0.1.) The disruptive strength is 45,000 volts (B.E.S.A. minimum 22,000.)

New South African Companies.—Among the new companies registered in South Africa during July were the Radio Apparatus Co., of South Africa, Ltd. (capital £6,000), the Wireless Corporation (S.A.), Ltd. (capital £1,000), and the Wireless Traders' Association of South Africa, Ltd. (nominal capital £2 10s.).

Sydney Municipal Contracts.—The Sydney City Council at a recent meeting unanimously adopted a recommendation that the Government be asked to appoint a royal commission to investigate the practice of adding sums to tenders to the council, among other bodies, for distribution among unsuccessful tenderers. The Government will also be asked to pass legislation making such practice illegal and punishable at law.—*Tenders.*

French Hydro-Electric Exhibition.—It is proposed to hold an exhibition of hydro-electric equipment and allied matters at Grenoble from May to October next year. The exhibition will also embrace electrical transport.

Vienna Metal Workers' Strike.—A general strike of Vienna metal workers involving over a hundred thousand men commenced on September 11th, all efforts to reach a settlement with the employers having failed. The strikers demand a 15 per cent. increase in wages, but the real issues are much wider, embracing the questions of the eight hours day and the burdens imposed on industries by taxation. The metal workers' unions include the employés in the municipal electricity works, who may join the strike later, in which case the city will be without electric light and tramway services.—*Reuter* (Vienna).

Russian Notes.—*Development Works.*—The Electric Planning Commission has adopted a preliminary scheme for the financing of electrical undertakings in the financial year 1924-25. In all a total credit of 16,880,994 roubles is asked for, of which 9,427,884 roubles is in the form of grants, and 7,423,000 roubles in the shape of long-term loans. The former amount applies to the financing of the Shterof and the Nijni Novgorod stations, which are to be started next year, and also to the completion of the Schatursk, Kashirsk, and Kizelof stations. A sum of 5,314,000 roubles is also required for the organisation and extension of the production of peat for the Nijni Novgorod and Schatursk stations, as well as of the Red October works.

The Central Electrical Trust.—This trust has prepared and presented for the consideration of the General Electrical Commission its productive programme for the new financial year beginning on October 1st. The gross output of the works in the Trust is estimated at 23,000,000 roubles on the basis of the price list of 1914, and 17,800,000 roubles according to the works' own cost, which represents an increase of 37 per cent. over that of the current financial year. The works of the Trust will absorb 3,000,000 roubles of the production, so that the net output for disposal in the market will be about 20,000,000 roubles. The Trust states that at the "Dynamo" works it is intended largely to extend the construction of transformers and tramway motors, for which there is a great demand, and similar machines are included in the programme for the Kharkoff works. An increase in the output of 37 per cent. at the former works and one of 50 per cent. at the latter works are contemplated. The cable works are to turn out products of the value of 6,250,000 roubles, or about the same as in this year; the lamp factories are to manufacture 8,500,000 lamps, or 73 per cent. more than in 1923-24. At present the productive capacity of the lamp factories amounts to 20,000 vacuum lamps and 2,000 gasfilled lamps per day; the output of the latter is to be considerably augmented in the new year. The production of the "Artema" porcelain works will be advanced by 100 per cent., and that of the "Isolator" works by 78 per cent. The Electro-carbon works will also increase its output of carbons and brushes.

The General Electrical Commission decided on September 1st that the prices of ordinary incandescent lamps should be reduced by 15 per cent. for lamps of up to 50 c.p. and by from 4 to 10 per cent. in the case of gasfilled lamps.

A Large Traverser for India.—*Indian Engineering* states that Messrs. S. H. Heywood & Co., Ltd., have recently constructed a 70-ft. electrical surface traverser for the Bengal-Nagpur Railway Co.'s Khargpur workshop. This is for moving rolling stock, and the height of the rails is only 6¾ in. above the running rails. It is designed to deal with very heavy loads (it was tested at 44 tons) at a speed of 300 ft. per minute. The power is supplied by a 50-h.p., 700-r.p.m., d.c. motor, controlled by a "tramway type" controller.

Unemployment.—There was an increase of 13,622 in the number of persons registered as totally unemployed on September 1st, the total being 1,162,700. The reduction since the beginning of the year stood at 122,923 on that date.

Installation Contracts.—Messrs. J. L. Etheridge & Co., Dover, inform us that they have recently secured contracts for electrical installations at Messrs. Boot's (chemists) new premises at Dover and Folkestone, and also at the premises of the World's Tea & Provision Stores, Ltd., Dover.

Swedish Industry and Dawes Programme.—Swedish industrial circles show anxiety in view of developments likely to follow on the realisation of the Dawes programme. The iron industry anticipates difficulties; on the other hand, the export of Swedish ore will gain by the extension of the market for German iron products.—*Reuter's Trade Service* (Stockholm).

Book Notices.—"Universal Directory of Railway Officials, 1924." London: The Directory Publishing Co., Ltd. Price, 20s. net.—The 30th annual edition of the Universal Directory of Railway Officials has now been issued. It is compiled chiefly from official sources, and contains a complete list of all the chief railway officials all over the world. The Directory is divided into eleven sections arranged as follows:—Official, Great Britain, Ireland, Europe, Asia, Africa, Australasia, North America, Central America, Mexico and West Indies, South America, and Personal Index of Railway Officials. The directory will be found to be most useful to engineering firms doing business with railways, in connection with correspondence, &c.

"Factory Lay-out, Planning, and Progress," by W. J. Hiscox. Pp. xi+184, 39 figs. London: Sir Isaac Pitman and Sons. Price, 7s. 6d. net.

Messrs. Henry Wiggin & Co., Ltd., Birmingham, have published a series of informative booklets on various non-ferrous metals and alloys. These are available to *bona fide* interested firms or persons and contain a great deal of useful data—physical and electrical. The booklets deal with cobalt, "Corronil" alloy, malleable nickel, the electro-deposition of nickel, alloys of nickel and chromium, alloys of copper and nickel, nickel silver, and resistance wires and tapes.

"Report of H.M. Inspector on Technical Education in England for the Paper Making Industry." (24 pp.) London: H.M. Stationery Office (for the Board of Education). Price 6d. net. This report outlines the education necessary to paper manufacturers, and criticises the existing facilities. Electrical engineering, in view of the development of the use of electricity in paper mills, is regarded as a necessary subject.

"Practical Notes on High- and Low-Frequency Amplifiers" is the title of a tiny 8-pp. pamphlet issued by Radio Instruments, Ltd., giving four diagrams for the use of those who are building their own sets, and explanatory notes, one of which we have found most fruitful.

"The Marconi Beam System." Pp. 21; figs. 6. London: Marconi's Wireless Telegraph Co., Ltd.—This well-produced pamphlet, No. 231, contains the main portions of a paper that Senatore Marconi read at the Royal Society of Arts recently, and was abstracted in our pages at the time.

"Alternating Current Rectification," by L. B. W. Jolley, M.A. (Cantab.), M.I.E.E. Pp. xviii.+352; figs. 244. London: Chapman & Hall, Ltd. Price 25s. net.

"Electrical Machinery and Control Diagrams," by T. Croft. Pp. xii+305; figs. 570. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

"Regulations for the Electrical Equipment of Buildings." (124 pp.) London: The Institution of Electrical Engineers. Price (cloth) 1s. 6d. net; (paper 1s. net).

Weights and Measures in Southern Rhodesia.—The Weights and Measures Bill of Southern Rhodesia proposes to consolidate and amend the laws of the Colony relating to weights and measures on the lines of the Union of South Africa Weights and Measures Act, 1922. Section 44 of the Bill provides that no person shall circulate in the Colony any price list or journal or other paper containing current prices of goods in which the denominations of weights and measures quoted or referred to denote or imply a greater or less weight than those authorised under the Bill. The Bill, if passed, will prohibit the sale of goods by the ton (2,240 lb.) or by the cwt. (112 lb.), by "reputed quart" or by "old measure," and the use of these terms will not be permitted in catalogues, &c., intended for distribution in the Colony.

Commercial Education.—We have received copies of a number of pamphlets issued by the London County Council educational authorities and a lengthy communication from the Royal Society of Arts respecting the facilities that exist in the London district for those who desire to make good use of their evenings during the coming months for adding to their commercial education. The information given is exhaustive, and should be of great service if it can be brought under the notice of the right people. In this connection an appeal is made to employers and managers controlling commercial businesses in the City and around to bring the importance of adding to one's qualifications for commercial life to the attention of their clerical and other employés. They are also advised to enable their employés to leave business at hours which shall enable them to attend the classes. Foreign languages, general subjects, such as bookkeeping, shorthand, typewriting, principles of commerce, accountancy, advertising, banking, economics, foreign exchanges, mathematics, salesmanship, are some of the subjects arranged for in the classes for those already out at business (senior students), while there are classes in general subjects for juniors not long passed out of the day schools. It is pointed out that advice from an employer on such a matter often carries more weight than the suggestions of a parent. It is also encouraging to an employé to know that his employers or others under whom he works are interested in his preparation to meet the battle of life. The need for improved commercial efficiency all round is so apparent, seeing that the trade outlook is a matter of such moment, that we have no hesitation in passing on the appeal to all who possess any influence with young people. Plenty of information is available from the Royal Society of Arts, John Street, Adelphi, W.C.2, and from the Education Department, L.C.C., at the County Hall, Westminster Bridge, S.E.1.

The Italian Hydro-Electric Industry.—The year 1923 was a prosperous one for the hydro-electric companies of Italy. The industry, which is a development of great national importance and which absorbs a considerable portion of Italian savings, is considered a safe and conservative investment by the financial interests of that country. Recent statistical data give returns for 355 plants, having a capacity of 1,564,216 h.p., with a share capital of 2,147,762,312 lire and bond issues totalling 13,364,342 lire. The plants are valued at 2,940,604,605 lire. The total profits distributed for the year by 131 companies amounted to 146,941,911 lire—an average dividend of 6.75 per cent.—*Commerce Reports.*

Export Trade Advice.—The September *Bulletin* of the British Chamber of Commerce, Paris, Inc., contains the following "Bye-words for future conduct of British Trade Abroad." The points will be familiar enough to many of our readers but they will bear re-stating in this concise form for the benefit of all at the present juncture:—

1.—Teach your boys one or more foreign languages, but teach them at an early age and thoroughly.

2.—Send your young men abroad for study and for commercial training.

3.—Study the requirements of foreign markets and make your goods to suit them.

4.—Employ British travellers speaking your prospective customer's language in preference to soliciting by post.

5.—Quote your customers in the weights and measures and currency of their country.

6.—Quote for your goods delivered at your customer's door. Shipping agents will invariably quote free delivery, duty and all charges prepaid.

7.—Your catalogues should be printed in your customer's language.

8.—Endeavour to meet your customer's requirements from the point of view of credit.

9.—Correspond with your customers in their own language and not in your own.

10.—Help to maintain the high standard of British commercial integrity.

11.—Make use, through your travellers and by correspondence, of our Commercial Attachés and Consuls and also British Chambers of Commerce abroad, who are able to help your business in very many ways.

The Electrification of Newfoundland.—"Hydro-electric Power Development in Newfoundland" is the title of a brochure which we have received, describing the great scheme for the generation of energy and the manufacture of paper that is being carried out in the west of Newfoundland, under guarantees amounting to about four millions sterling granted under the Trade Facilities Act and by the Newfoundland Government. About 100,000 h.p. is to be generated from the waters of Grand Lake and utilised in a pulp and paper mill at Corner Brook, having an annual output of 120,000 tons of paper. The plant is to be in operation by July next year, and the main contractors are Messrs. Armstrong, Whitworth and Co., who are making the steel pipes, 4,000 tons in weight, and building the turbines; the alternators and switchgear are being supplied by the British Thomson-Houston Co., Ltd. For heating the rolls of the paper-making machinery, 200,000 lb. of steam per hour will be provided by two 25,000-kW electric boilers; there are also four Babcock & Wilcox fuel-fired boilers. The brochure includes a number of striking illustrations of the hydraulic works, turbines, &c. The plant will comprise seven 14,000-h.p. turbines, and power will be transmitted 32 miles to the mill at 66,000 volts by aluminium cables.

Municipal Administration and Private Interests.—The recent judgment by the late Mr. Justice Bailhache in the case of the Leeds alderman who was a member of a firm in receipt of contracts from the City Council has had a further development in the city. Mr. T. Harding Churton, a Leeds councillor, and also a director of the Middleton Colliery Co., which has had many contracts from the Council, announced his resignation from that body on September 9th. Mr. Harding Churton is principal partner in the Leeds firm of electrical engineers bearing his name.

Australian Anti-Dumping Duties.—Among the articles to which the provisions of the Anti-Dumping Act have recently been applied are electric fuses of United States origin.

Greek Electricians' Strike.—During last week a widespread strike of electricians held up the tramway system in Athens. The lighting supply was maintained.

Trade Discounts to Wireless Retailers.—We are informed by the Wireless Retailers' Association that its efforts, extending over more than a year, to obtain better discounts have at length been rewarded by increased percentages now allowed by nearly all manufacturers. It is stated that a host of abuses are still crying out for reform, and the Association appeals for the further support of all *bona-fide* dealers.

International Fair at Vienna.—Reuter reports that the seventh International Vienna Autumn Fair (to last a week) was opened at Vienna on September 7th, and promised to be a great success, numbers of buyers journeying there from the Leipzig Fair. Exhibits were numerous, especially in the textile and machinery sections. The foreign element among the exhibitors was very prominent, 14 or 15 States being represented. As usual the German contingent was the strongest, especially in machinery and hardware.

Lighting and Power Notes.

Australia.—HYDRO-ELECTRIC SCHEME.—The Federal Government and the Government of New South Wales have under consideration a scheme for the utilisation of the waters of the Snowy river for generating electricity. Electrical energy will be transmitted to Eden seaport in Twofold Bay, a distance of about 80 miles, where it is proposed to erect large industrial works. The cost is estimated at £2,700,000, and the output at 150,000 h.p.

VICTORIA.—The Northcote City Council has decided to spend £12,000 on electricity extensions.

Barnsley.—LOAN.—Application is to be made to the Electricity Commissioners by the Town Council for sanction to a loan of £5,230 for the provision of mains in the areas added to the borough.

Batley.—ELECTRICITY IN BULK.—The Corporation proposes to obtain a bulk supply of electricity from the Yorkshire Electric Power Co., Ltd., and has requested the company to submit a draft agreement embodying terms.

LOAN.—Application is being made to the Electricity Commissioners for sanction to the borrowing of £5,750 for extensions and alterations to the electricity works.

Birkenhead.—ELECTRICITY SUPPLY.—The last of eight substations was recently opened at Prenton by the chairman of the Electricity Committee. All the eight stations in the ring have been interconnected and one station has been set aside in readiness for expected developments in the Bromborough and Bebington districts. Each station is equipped with a 500-kW transformer.

Bradford.—LOAN SANCTIONED.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £168,000 for electricity purposes.

Byfleet.—STREET LIGHTING.—The Chertsey Rural District Council has arranged with the Woking Electric Supply Co., Ltd., to install forthwith electricity for street lighting in the district.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Plans are being prepared for a hydro-electric plant, to be constructed at Grand Falls on the St. Croix River, with an initial capacity of 60,000 h.p. The St. Croix river is a boundary stream between the State of Maine and New Brunswick.—*Reuter's Trade Service* (New Brunswick).

ONTARIO.—The fourth set at the Nipigon hydro-electric developments at Cameron Falls is to be put into service this month, bringing the plant capacity up to 50,000 h.p. The fifth and sixth units are to be completed within a few months.

Carlisle.—LOAN SANCTIONED.—The City Council has received the sanction of the Electricity Commissioners to a loan of £1,322 for mains.

Continental.—ITALY.—A scheme is proposed for the construction of a lake in the province of Savona, for the generation of electricity on a large scale and for irrigation purposes. This lake is to be placed in the highlands which border the Valley of Sansobbia. The dam to be constructed will be situated 300 metres above the confluence of the Crivezzo and is to be 168 ft. high.

The following installations have received Government sanction:—A 130,000-V h.p. line from Gozzano, province of Novara, to Arquata Scriva, province of Alessandria, to be carried out by the Società Generale Edison di Elettricità; a 75,000-V h.p. line from Mogreno to Mirafiroi, province of Turin, to be carried out by the Società elettrica Alta Italia; a 70,000-V line from the sub-station S. Bartolemso in Brescia to the S. Bernardo sub-station in Cremona, to be undertaken by the Società Bresciana.

FRANCE.—Plans are being prepared for the erection of a hydro-electric power station at Guerledan, in the Department of Morbihan.

During the war the German authorities constructed a small central station at Hirson (Department of the Aisne), which was subsequently taken possession of by the French Armies; it had an output of over 5,000 kW in 1921. It has now been decided to transfer the station, which supplies energy in the department named and the district of Fourmies in the department of the Nord, to the Société Electricité et Gaz du Nord, which has been carrying on the station since the end of 1922 on behalf of the State.

EAST PRUSSIA.—The power station at Osterode, which supplies electricity to a number of towns, was recently destroyed by fire, and the towns affected are without light.

ESTHONIA.—Under the hydro-electric scheme on foot at Narva, which has been under consideration since 1919, it is proposed to construct a large water power plant for the complete electrification of the country; it is thought that 62,000 h.p., or, at least, 21,600 h.p. could be made available. The amount required for putting the scheme into effect is 1,500,000,000 Esthonian marks. It is understood that the Government has entered into negotiations with a British financial group in order to obtain a loan, amounting to £1,500,000. The whole question has quite recently, however, entered a new phase, as two industrial firms at Narva are disputing the State's ownership of the rapids. The question has been laid before a special committee for consideration.—*Reuter's Trade Service* (Helsingfors).

BELGIUM.—The Société de l'Electricité de l'Est de la Belgique has secured the concession for the supply of electricity for lighting and power purposes in the town of Verviers.

SWITZERLAND.—A new record in output was made last year by the electricity undertaking in Basle. The electricity supplied for power purposes advanced 9.5 per cent., that for lighting 7.4 per cent., and that for heating and cooking 13.7 per cent. Of the total output of 84,888,500 kWh, 60,520,000 kWh was consumed in the town of Basle, 20,055,000 kWh in Basle Canton, the remainder being supplied to the Bernischen Kraftwerke Gesellschaft and the Columbus Motor Gesellschaft.

RUMANIA.—There were, according to statistics, in 1922, 67 generating stations in the new territories acquired by Rumania as a result of the war, making a total at the present day for the whole kingdom of 124. Of the new stations particulars are forthcoming for 52 only. These stations have a total capacity of 31,816 kW and an output of 50,000,000 kWh per annum.

Edinburgh.—YEAR'S WORKING.—The accounts of the city electricity undertaking for the year ended May 15th last record a total income on revenue account of £433,740, an expenditure of £224,023, and a gross surplus of £209,717. In the preceding year the figures were: Revenue £417,812, expenditure £221,966, and gross profit £195,846. The capital charges, totalling £192,030, and including an amount of £98,528 for debt repayment, were considerably higher, reducing the net profit from £46,449 to £17,687. This was transferred to the reserve fund, raising that fund to £205,032. The capital account shows a total expenditure of £3,197,150, of which £232,783 was incurred during the past year. The latter figure includes £89,684 for mains, services, and transformers, £73,721 for machinery and plant at Portobello, £27,372 for land and buildings for that undertaking, and £14,815 for sub-station plant. The sales of energy increased considerably—from 42,233,150 kWh in 1922-23 to 52,781,659 kWh last year. The traction supply contributed most to this increase.

Golborne.—ELECTRICITY SUPPLY.—The Lancashire Electric Power Co. proposes to provide a supply of electricity for lighting purposes in the district. It will not be possible, however, to obtain the Special Order until the autumn session of Parliament.

Herne Bay.—SPECIAL ORDER.—Messrs. Hunt & Sons, Mortimer Street, Herne Bay, have applied to the Electricity Commissioners for a Special Order authorising them to supply electricity within the urban district and in certain parishes in the rural district of Blean.

London.—HAMMERSMITH.—*Year's Working.*—The accounts of the borough electricity undertaking for the year ended March 31st last record a total income of £179,221, as compared with £161,241 in the preceding year. The working expenditure was £103,408, as against £88,357, leaving a gross profit of £75,813 (£72,885), to which was added interest of £173, making a total of £75,986. Capital charges absorbed £60,552, and there was a net profit of £15,434, as compared with a surplus of £24,981 in 1922-23. The capital expenditure during the year amounted to £46,468, the chief item being £31,206 for machinery, bringing the total expended on the undertaking to £796,445. The sales of electrical energy increased from 16,255,290 to 20,126,879 kWh, and the average price obtained fell from 2.36d. to 2.09d. per kWh. The maximum supply demanded rose from 9,715 to 12,440 kW, and the number of consumers from 6,941 to 7,443.

Motherwell.—PROPOSED PLANT EXTENSIONS.—The electrical engineer has submitted a report to the Town Council on the necessity for extensions to the generating plant in order to cope with the anticipated increased output. He states that a new set of from 2,500 to 3,000 kW capacity run in conjunction with the present turbine would meet the needs of the station extension. Application is to be made to the Electricity Commissioners for sanction to proceed with the scheme. During the year the sales of electrical energy have increased by 985,450 kWh, and the number of new connections by 294.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

GOOLE.—*The Electrical Distribution of Yorkshire, Ltd.*—Lighting: From 7d. to 6½d. per kWh. Domestic power: From 2d. to 1½d. and 1d.

HOVE.—Lighting: From 7d. to 6½d. per kWh.

Preston.—PROPOSED EXTENSION OF SUPPLY.—The Town Council is to hold a special meeting to consider the question of applying to the Electricity Commissioners for an Order to supply electricity to Leyland, Walton-le-Dale, and surrounding districts. Mr. J. A. Robertson, consulting engineer to the Corporation, states that a canvass of power users in Leyland and Walton-le-Dale areas shows that a substantial demand might be expected for power purposes. The potential power load in Walton-le-Dale and Leyland district was approximately 18,000 kilowatts. Mr. Robertson recommended the laying of duplicate transmission lines from Ribble power station to a sub-station in Leyland, a distance of 5½ miles. One transmission line would be looped to a sub-station at Tardy Gate, where the pressure would be reduced to 6,000 V for supply to Walton-le-Dale district. Regarding Preston Rural Council, an extension of the existing 2,000 V cable from Penwortham to Langton village is suggested. The estimated expenditure on the scheme is £72,000.

(Continued on page 437.)

Electric Vehicles at Wembley.

Some of the Battery-driven Exhibits.

ONE of the most interesting features of the British Empire Exhibition, so far as electric battery traction is concerned, is the fleet of 200 "Railodoks" which affords such a convenient means of conveyance for a general survey of the show grounds, wherein there are some 15 miles of roadway. These quaint little cars wending their way amongst the dense foot traffic provide an object lesson in the wonderful control that can be obtained over an electric vehicle; with no other form of transport would it have been possible to provide similar service under the conditions obtaining. The popularity of this means of transport is evidently considerable, for over a million passengers were carried in less than four months with only six minor accidents, and these attributable to carelessness on the part of the public.

Fig. 1.—"Railodoks" leaving Wembley Garage.

As industrial trucks, "Railodoks" are familiar in railway stations, docks, factories, &c., but the Wembley fleet is the first example of the use of such vehicles on a large scale for passenger carrying. Primarily intended to operate upon smooth roads and concrete or wooden floors, the trucks must be credited with an achievement of some merit, shared by the "Kathanode" batteries with which they are equipped, in that they have successfully negotiated, at the low speed dictated by considerations of public safety, the irregular (to say the least) Exhibition roads and stiff gradients.

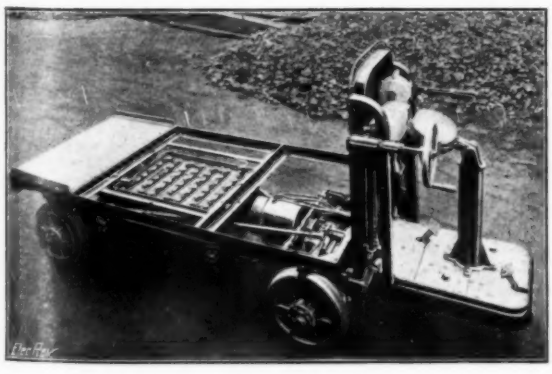


Fig. 2.—Standard Truck Chassis.

The "Railodok" Fleet.

The 200 standard trucks, some of which are shown in fig. 1, specially adapted for carrying passengers, were manufactured by Messrs. G. D. Peters & Co., Ltd. (whose selling agents are Messrs. Walker Vehicles, Ltd.). Each car consists of a 1-ton truck chassis, as illustrated in fig. 2, fitted with "garden seat" type accommodation for 12 passengers and equipped with a canopy. A folding step runs the complete length of the vehicle, and is operated by a lever on the driver's platform; when in the "lifted" position it lies flat along the side of the chassis, thus keeping the overall width of the vehicle down to the minimum. The seats, which are placed transversely, are easily removable to give access to the motor and to the battery, and a feature which deserves mention is the fact that the driver's seat is hinged and sprung and so mechanically and electrically interlocked with the brake and controller that immediately the driver's weight is removed the brake is automatically applied and the current cut off. This is a very efficient safety device which is doubly desirable when the trucks are used for the conveyance of passengers, particularly in congested localities.

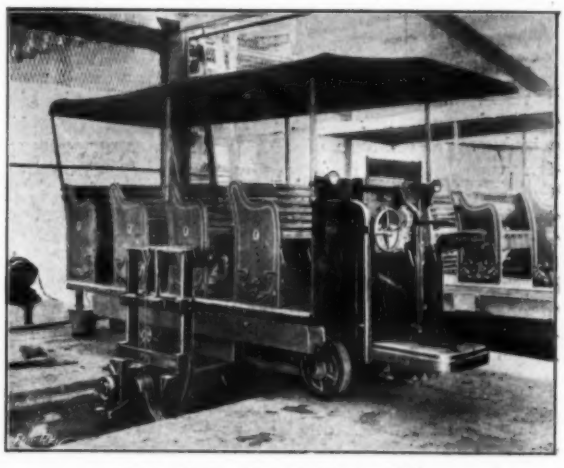


Fig. 3.—Battery Removing Gear and Pit.

Worm steering is used to guard against the effects of road shocks, and the cars are each fitted with two head and one rear Lucas electric lamps. The driving motors are of the vehicle type manufactured by the Metropolitan-Vickers Electrical Co., Ltd., of 3 h.p., 880 r.p.m., 40 volts. The axles are fully sprung at the front and back, the motor being carried on a cradle so as to move with the springs; the drive is through a Hardie flexible coupling, worm and simple differential gear. The resistances were supplied by the Rheostatic Co., Ltd.

The fleet is equipped with lead accumulators of the "Kathanode" type, which are manufactured by the

D.P. Battery Co., Ltd., the number supplied being as follows:—50 "T R" batteries of 21 cells, 15 plates, 168 Ah; and 150 "T R" batteries of 21 cells, 19 plates, 216 Ah. This type of cell has resulted from the development of accumulators for use in submarine boats, and the construction involves principles which render the cells unusually robust. In effect, the design marks a departure from previous methods, one of the principal features being an "indestructible" envelope acting as a separator, which holds the active material firmly in place and, at the same time, permits the chemical action of the cell to proceed normally.

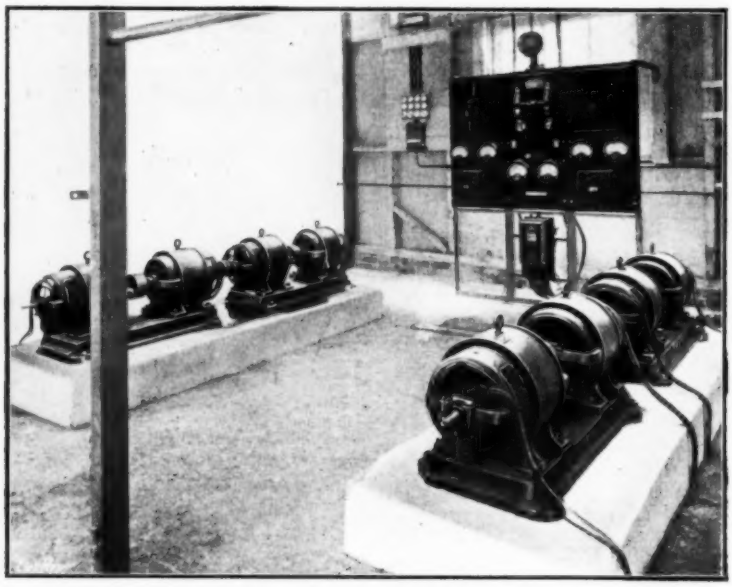


Fig. 4.—Power Switchboard and 5-wire Balancers.

In spite of the very exacting conditions which prevail at Wembley—where some of the gradients are as steep as 1 in 10—it has been found possible to obtain a run of approximately 18 miles on a single charge—a distance which can naturally be materially increased under more favourable conditions, such as those which normally obtain in purely industrial service.

The Wembley Electric Garage.

The "Railodok" services radiate from a depôt which is itself worthy of attention, being the largest of its kind in this country. The garage, which covers an area of 20,000 sq. ft., was specially designed by Sir Owen Williams, K.B.E., and the construction carried out by Messrs. Humphreys, Ltd. Accommodation for the whole of the fleet is provided in this garage, which also contains workshops, charging plant, and the offices from which the whole organisation is controlled. The equipment of the garage as a charging station was entrusted to Messrs. Drake & Gorham, Ltd. The problem of providing a suitable battery charging equipment was a somewhat unusual one; the electricity supply available was d.c., 3-wire, 440 volts between outers, taken from the power station in the Exhibition grounds, while the voltage required for each of the vehicle batteries was approximately 55. It was also necessary that any number of batteries from one to one hundred should be able to be charged at the same time.

To enable this to be done, three copper conductors, corresponding to the two outers and neutral of the supply mains, are carried overhead down the centre of the building. Between the outer and neutral on each side of the system three additional copper conductors of smaller section are laid, and a 5-wire balancer has been introduced on each side of the neutral, thus splitting each of the 220-V legs of the incoming 3-wire 440-V mains into 9 wires, or 8 legs of 55 volts each.

A reverse-current B.T.-H. relay is provided on the switchboard, and each of the two Holmes (Newcastle) balancers comprises four machines on one shaft, 1,350 r.p.m., 55 V, 22.5 A, as shown in fig. 4.

For the purpose of regulating the current supplied to individual vehicles, 100 Drake & Gorham charging panels are connected to the appropriate conductors, each being fitted with an ammeter, iron-clad switch-fuse, regulating switch, resistance, and an indicating lamp of distinctive colour. The colours are arranged so that each corresponds to one group of vehicles, and, as all the charging panels are placed along an overhead gallery, fig. 5, the attendant can, by glancing along the row of panels, ascertain which of his charging circuits are operating and how many vehicles are on each. Any difference in the total current taken by the batteries connected between the same pair of leads, as compared with the amount required by those between any other pair, is dealt with by the balancers, care being taken to keep the "out of balance" current as small as possible by placing the vehicles, as they come in, in the most suitable position, having regard to the state of the particular battery and the charging current required. As the balancers have a capacity which is greater than the normal charging current of a single battery, it is possible to charge simultaneously any number of vehicles from one to the full number with which the plant is capable of dealing. A 15-plate battery can be charged in 22 minutes, and 120 cars being charged at once require 975 amperes at 440 volts.

The current is led from the charging panels to the vehicles by Henley 3-core c.t.s. flexible leads fitted with Reyrolle charging plugs, suspended from the garage roof, as shown in fig. 6, immediately over positions taken up by the cars. This arrangement ensures absence of delay in putting cars on charge, and all the plugs are

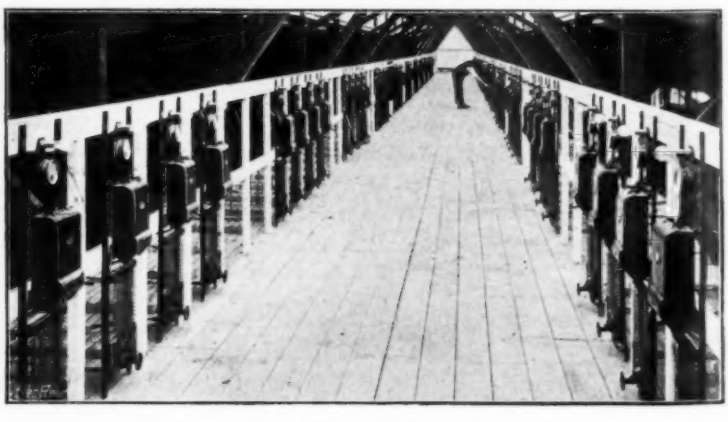


Fig. 5.—Charging Panel Gallery.

earthed to busbars connected to the steel framework of the building.

In order to maintain the maximum service possible, the charging arrangements have had to be carefully planned; the system is a simple one: During the period when the Exhibition is closed, the trucks are put on charge in two relays and the batteries fully charged; by day, while the services are running, the trucks return

to the garage in batches and receive "boost charges" at intervals which are made to correspond, so far as is possible, with periods of minimum traffic demand. The load during the day time is about 200 kW, and at night 300 kW. During the "boost charging" the rate is several times higher than normal, and it is claimed that no lead battery other than the "Kathanode" could withstand the high rates of charge and discharge, coupled with the severe jolting over the very uneven surface of the roads.

Apart from the battery charging arrangements, there

Fig. 6.—Garage Interior, showing Flexible Charging Leads.

is a complete organisation in the garage which deals with cleaning, overhauling, and running repairs. Fig. 3 is a view of a car over the battery changing pit, showing the gear which is used to remove a battery easily and quickly. A Peters portable motor-generator plastic arc welding set has been found of great utility in the workshops. Traffic, route, and driving staff arrangements are controlled by inspectors and superintendents who operate on a system very similar to that of the London General Omnibus Co. Mr. P. Alexander is the traffic manager, and Mr. R. Tuddenham the engineer-in-charge.

In addition to the ordinary passenger services, "Railodok" trucks are performing several interesting duties at the British Empire Exhibition. Few visitors will have failed to see the little box-vans which collect cash from the turnstiles and convey it to the bank. There is also the truck with trailers which, carrying sanitary dustbins, forms part of the Exhibition authorities' efficient refuse collection organisation. Early visitors at the Palace of Engineering will probably have seen the truck and trailer, fitted with tank bodies, which are used by the British Petroleum Co., Ltd., to deliver fuel oil to exhibitors. A standard 1-ton Walker lorry, incorporating the "balanced drive" which has been described in our pages, is also used by the breakdown gang. Undoubtedly the British Empire Exhibition has provided an exceptional opportunity to demonstrate the usefulness and success of the "Railodok" as a passenger vehicle under certain conditions and to indicate its utility in industry.

A New Mobile Crane.

A new mobile petrol-electric crane designed on the Ionides system is exhibited by Messrs. Ransomes and Rapier, Ltd., in the Palace of Engineering. The standard 2-ton model shown is the first constructed, but such cranes can be supplied up to 5 tons in capacity. The crane will travel anywhere where a lorry can go, and is designed to deal with goods which are too heavy to be man-handled, as illustrated in fig. 7.

The crane is provided with two large rubber-tired road wheels in front mounted on a fixed axle, and the rear end is supported on a two-wheeled castor, which is both the driving and steering element. The axle of the castor is articulated so as to adjust itself to uneven ground, and is mounted on a centre post, the steering and slewing being carried out by shafting and a steering wheel, the centre round which the crane revolves being in the middle of the fixed front axle.

The crane is propelled by two independent electric motors, each of which is connected by gearing to the respective wheels of the castor. The motors are in series, and owing to the articulation of the castor axle, the load is equally borne on the two wheels, and consequently the torque exerted is the same for each. This arrangement obviates the necessity for differential gearing as would otherwise be the case when turning in a small circle. The hoisting and derricking motions each have independent motors and automatic self-sustaining electric brakes.

Power is generated by means of a 20-h.p. petrol engine directly coupled to an 8-kW dynamo generating at 240 volts, 1,500 r.p.m. The engine is provided with a self-starter, dynamo, and battery, so that side and tail lights and a suitable cluster on the jib can be provided for night work.

Simple foot and hand control is employed; a combined reversing switch box is used for the operation of the three motions: hoist, derrick, and travel. After engaging a control switch for the required motion, the necessary power is built up by depressing the accelerator governing the speed of the engine. An automatic inter-

Fig. 7.—Ransomes and Rapier Mobile Crane.

locking device makes it impossible to engage any switch when the generator is producing more than 50 volts, thus obviating any possibility of stalling the engine, or imposing sudden loads on the motors, or stresses on the gears. The brakes can be left "on" after the driver has removed his foot from the pedal, while the hoist and derrick motions are fitted with Lewis self-adjusting solenoid brakes.

(To be concluded.)

New Tramway Cars for Cape Town.

Vehicles of Large Carrying Capacity.

THE Cape Electric Tramways, Ltd., have added to their rolling stock six double-deck top-covered cars, with a carrying capacity very much in excess of the average. Designed mainly for dealing with the "rush-hour" traffic in Cape Town, each car is capable of seating 106 passengers in addition to carrying a considerable number of standing passengers. The cars, one of which is illustrated in fig. 1, measure 41 ft. 9 in. in overall length, the saloons being approximately 7 ft. longer than those of the latest London County Council bogie cars; they are believed to have more passenger accommodation than any electrically-operated tramcar yet constructed in this country.

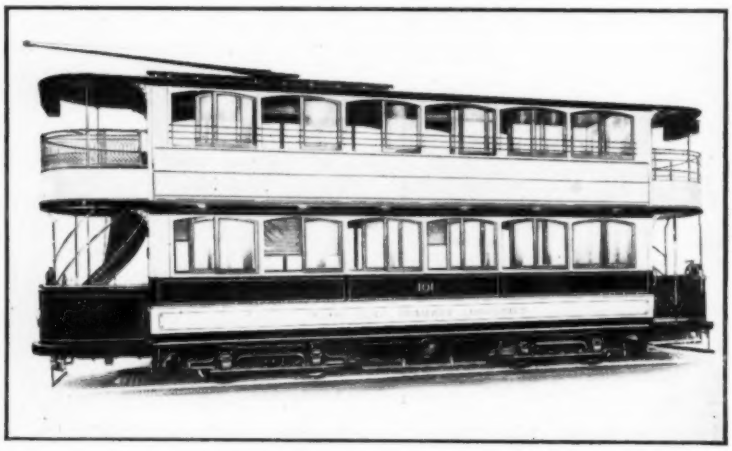


Fig. 1.—New Tramcar for Cape Town.

Each car is mounted upon two equal-wheel, swing-bolster, centre bearing and side radius plate bogie trucks, and is equipped with four motors collecting current from the usual overhead wire. Air brakes are fitted, each car having a separate motor-driven air compressor, besides the usual mechanical brakes, so that each wheel has two brake shoes; the air brake operates the same shoes as the hand gear, but pressure is applied independently of the hand brake. For economising space on the platforms, vertical hand wheels are used instead of the usual ratchet handles.

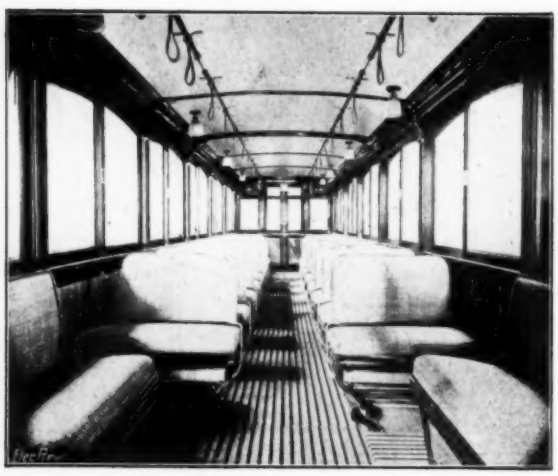


Fig. 2.—Interior of Lower Saloon.

The cars embody several special features, and in view of their exceptional length, special attention has had to be given to strength, particularly as the cars were built so that they could be shipped in sections in order to economise shipping space.

The underframes are of rolled steel sections strengthened the full length by deep truss plates, ensuring a rigid bottom framing throughout, and at the same time giving the required support to the ends of the car body, thus preventing "sag." The main body framing is teak, the panels being of mahogany. The interior of the lower saloon is finished in teak and oak, the ceiling being enamelled white. The majority of the seats are of the "walk-over" pattern, arranged transversely with swing-over backs, whilst a short longitudinal seat is fitted in each corner. The covering material is woven rattan cane on a spring frame. The lower saloon, illustrated in fig. 2, has a seating capacity of 48 passengers. The upper saloon, illustrated in fig. 3, is finished in pitch pine and teak, the ceiling being enamelled white. The seats are of the standard wood lath pattern, and a curved seat is provided on each top deck canopy, the total seating capacity being 58 passengers. The side windows are of a special type, the space between each pair of pillars being provided with two teak glazed frames, one fixed and the other arranged to slide horizontally over the face of the fixed frame. All side windows have spring roller blinds.

The internal lighting is liberal, the fittings including "satin finish" glass shades, and Edison type screw-socket lamps.

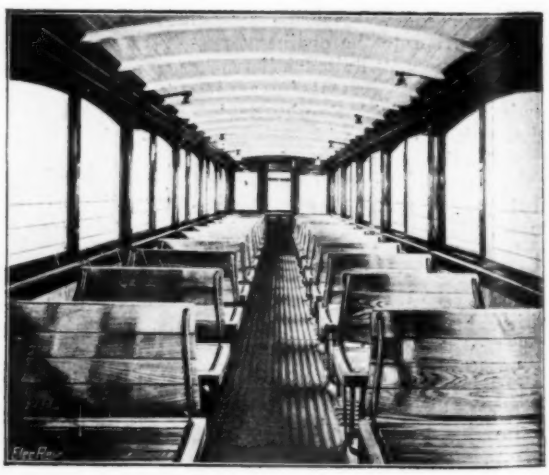


Fig. 3.—Interior of Upper Saloon.

Each car is equipped with the usual accessories, and the colour scheme is a combination of green and cream.

The car bodies and trucks were built by the Brush Electrical Engineering Co., Ltd., of Loughborough, to the order of Mr. Fearnside Irvine, M.I.E.E., M.Inst.C.E., M.I.Mech.E., consulting engineer to the Cape electric tramways, while the motor equipment and air brake apparatus were supplied by the General Electric Co., of America.

Lighting and Power Notes.

(*Continued from page 432.*)

Rochdale.—EXTENSION OF SUPPLY.—The Town Council has approved a scheme for supplying electricity within the urban districts of Norden and Wardle, and has decided to apply to the Electricity Commissioners for a Special Order authorising it to supply in these areas.

Sheffield.—UNEMPLOYMENT SCHEMES.—In a report on the provision of work for the unemployed during the coming winter the Finance Committee has recommended the following, subject to the necessary grants being obtained:—E.h.p. feeder mains: Between Manor Estate and Handsworth sub-stations £9,559; from Abbey Lane to the city boundary, £28,500; Crookesmoor and Hangingwater Road sub-stations, £9,590; from Blackburn Meadows power station to High Hazels Colliery, £15,810.

South Africa.—KING WILLIAM'S TOWN.—The Town Council has decided to proceed with the scheme for the erection of a new power station, and tenders have been accepted for the supply of plant, cable, &c. The total cost of the scheme is £90,000.

Special Orders.—NOTICES OF APPLICATION.—The *London Gazette* dated September 12th contained notices of applications for Special Electricity Orders by the Gwynedd Trust, Ltd., in respect of the following areas:—Welshpool and District; Criccieth and Portmadoc District; Pwllheli and Lleyn; Flint and Holywell District; Sandbach, Alsager and District; Denbigh and St. Asaph District; and Gwyrfai and Bethesda District.

Stockport.—NEW PLANT.—The Town Council has received a report from its consulting engineer (Mr. C. P. Sparks), on the proposed extensions to the Millgate electricity works, and has decided to apply to the South East Lancashire Electricity Advisory Board for sanction to install two 10/12,000-kW turbo-alternators. The scheme is to be carried out in two stages, the first to be proceeded with at once, and the second immediately necessity arises, the cost of the stages being £90,000 and £80,000 respectively. The borough electrical engineer has been instructed to prepare the necessary plans, &c., and application is to be made to the Electricity Commissioners for sanction to the borrowing of £90,000 for the first portion of the scheme.

Torquay.—STREET LIGHTING.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £1,500, for converting to electricity 300 street gas lamps.

Tramway and Railway Notes.

Australia.—MELBOURNE.—It is reported that the Melbourne Tramway Board is to borrow £500,000 locally in order to carry out various work.

NEW SOUTH WALES.—According to *Tenders*, the New South Wales Public Works Committee is at present taking evidence regarding the proposed electric railway from Tempe to East Hills, *via* Salt Pan Creek, a distance of 10¼ miles and estimated to cost, exclusive of land resumptions, £422,836.

Bradford.—YEAR'S WORKING.—The accounts showing the working results for the year ended March 31st last of the Corporation tramways (manager: Mr. R. H. Wilkinson) show a total income of £619,581, and a working expenditure of £487,585. In the previous year the revenue was £662,731 and the expenditure £470,986. Thus the gross profit was £131,996, as against £470,986. The revenue from the railless car system was £20,298 (£21,230), and the working expenditure amounted to £25,419 (£26,506), leaving a gross deficit of £5,150 (£5,297). The parcels department showed a gross profit of £1,315, as compared with £1,396 in the previous year. The net results were as follows:—Tramways, £50,268 profit; railless car system, £7,886 deficit; parcels department, £917 profit, making a total net profit of £43,299, as against a profit of £105,171 in 1922-23. Of this amount £13,000 was contributed to the borough fund and £14,000 to capital account, leaving a balance of £16,299, which was transferred to reserve account. In the previous year £57,672 was carried to this account. During the year £96,494 was spent on capital account, of which £80,084 was expended on permanent way. The number of passengers carried was 92,683,421 (tramways 89,082,417), as against 85,289,558 (tramways 82,046,210) in the preceding year, and the car-mileage was 6,863,348 (tramways 6,455,112), as compared with 6,513,814 (tramways 6,121,622). Application was made to the Ministry of Transport for an Order authorising the Corporation to use railless cars on 31 routes inside and outside the city. In view, however, of the opposition of the various District Councils it was decided to abandon the application with regard to all routes except those between Lidget Green and Clayton, an Order for which has been made by the Ministry of Transport and is now awaiting Parliamentary confirmation.

LOAN SANCTIONED.—The Corporation has received the sanction of the Minister of Transport to the borrowing of £14,589 for the reconstruction of the tramway track in Halifax Road between Odsal Top and Buttershaw Lane.

Continental.—SWEDEN.—The report of M. Koerner, who has been charged with the investigation of the problem of the electrification of certain private railways in Sweden, is expected to appear in November. The investigation shows that electrification would be profitable on some railways with a large traffic, such as Bergslagernas Jaernvaegar, and Stockholm-Vaesteraas-Bergslagens Jaernvaeg.—*Reuter's Trade Service* (Stockholm).

ITALY.—The Government has placed the concession for the construction of the electric railway from Calalzo to Dobbiaco, a distance of 65,335 km., with the Società per la Ferro via delle Dolomiti. The outlay on the undertaking is estimated at 12,215,800 lire. A condition of the concession is that the company may allow foreign firms to supply equipment to the extent of half the total requirement.

Doncaster.—RAILLESS CARS.—The Corporation has approved a recommendation of the Tramways Committee that the present tramway track be gradually replaced by a railless-car system.

Japan.—A NOVEL "STRIKE."—Angered because the head of the electricity department was forced to resign, municipal tramway employés at Tokio are threatening, says the *Daily Mail*, to operate the tramway cars without collecting fares till the City Assembly capitulates.

New Zealand.—RAILWAY ELECTRIFICATION.—The Minister for Railways states that, owing to the increasing difficulty of handling Auckland's suburban railway traffic, the Government has decided to investigate the question of electrifying the suburban railways of the four centres, Wellington, Auckland, Christchurch, and Dunedin. Engineering firms are being communicated with, and a report will be obtained on all aspects of the problem.—*Australasian Electrical Times.*

Salford.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager, Mr. J. S. D. Moffet) for the year ended March 31st last show that the total revenue of the system, including interest on investments, &c., was £534,804, as compared with £536,350 in the preceding year. Working expenses totalled £399,222, as against £403,035, leaving a gross profit of £135,681 (£133,315). After charging loan interest, &c., there was a net profit of £42,202, as compared with £42,458 in 1922-23. This has been distributed as follows: Relief of rates, £10,000; depreciation and renewals fund, £32,202. All the above amounts embody the figures for the motor-omnibus services. The number of passengers carried increased from 78,538,355 to 80,365,747, and the number of car-miles run from 6,279,656 to 6,307,301. The receipts per car-mile fell from 19.257d. to 18.784d.

Swansea.—MUMBLES RAILWAY ELECTRIFICATION.—The chairman of the Swansea Improvements and Tramways Co. states that sanction to proceed with the electrification of the Mumbles railway is expected from the Ministry of Transport about the middle of October. An agreement has been arranged with the Corporation Electricity Committee for a supply of electrical energy, and a sub-station will be erected at Mumbles for the purpose. It is anticipated that the scheme will be completed by the middle of next year.

Sunderland.—LIGHT RAILWAY ORDER.—The Town Council has decided to apply to the Minister of Transport for an Order authorising it to construct light railways in the borough; these represent extensions of the tramway system already decided upon.

Telegraph and Telephone Notes.

Austria.—NEW RADIO SERVICE.—A radio telegraph service has recently been inaugurated between Vienna and Cracow.

"EXPRESS" TELEPHONE CALLS.—Express telephone calls at 30 and 9 times the usual rate have been introduced between Vienna and certain German cities.

CONGRESS.—A congress of the postal, telegraph, and telephone workers of 17 countries, including Great Britain and the United States, was opened in Vienna on September 15th, says *The Times.*

Canada.—TELEGRAPHISTS' STRIKE.—A Dominion-wide strike of telegraph operators employed by the Canadian Press Association started on September 11th. The telegraphists of the Canadian Pacific Railway and the Canadian National Railway are also refusing to transmit news messages. Only the United Press service is available for the newspapers, whose news services are disorganised. The strikers protest against the proposed wage reductions, and have refused to make an appointment to the Board of Conciliation authorised by the Minister of Labour.—*The Times.*

Channel Islands.—Cable Service Interruption.—Telegraph communication with the Channel Islands broke down for a time on September 12th. A service was maintained by wireless until the cables began working again.—*Evening News.*

Germany.—Cable Developments.—It is reported that two of the directors of the German Atlantic Telegraph Co. and a representative of the Reich Postal Department have arranged a contract with the Portuguese Government under which the company has obtained a concession for landing rights at the Azores of a cable which will be laid thence from Emden, while the further connection between the Azores and New York will be effected by the Commercial Cable Co. under agreement. The financing of the German section is stated to have been arranged by the Disconto Gesellschaft in such a form that the American money market has been opened without affecting the independence of the company. The firm of W. A. Harriman & Co., for instance, is said to have taken over an obligation loan of the German company for the amount of 3,800,000 dollars, which is to be disposed of in the United States. It is further mentioned that the German company has reached an understanding with the Eastern Telegraph Co. with regard to the South American traffic, and is in course of extending its connections with the East in association with the Great Northern Telegraph Co.

Radio in the Air.—Direction-Finding.—Direction-finding by wireless has proved so valuable on the British air-lines by indicating to pilots their position when landmarks are invisible, that an official scheme has been drafted extending the system to the airways covering Western Europe. Co-operation between Great Britain, France, Belgium, and Holland will result in the regular operation of direction-finding stations.—*Daily Mail.*

Rhodesia.—New Radio Station.—Forthcoming Government expenditure in Southern Rhodesia will include £12,000 for a radio station at Salisbury.

New Telephone Switchboard.—The Government is to provide a new telephone exchange switchboard at Salisbury at a cost of £8,000.—*The British S.A. Export Gazette.*

Switzerland.—Telephone Cable.—Among the important contracts completed last year by the Felten and Guilleaume Carlswerk Gesellschaft, of Mulheim, Cologne, was one for a telephone-cable installation connecting Germany and Switzerland, which is now said to be operating satisfactorily.

The Telephone Service.—Street Kiosks.—In spite of the need for more telephone call boxes and kiosks, the G.P.O. states that there are only about 700 in the country. There are objections from many of the local authorities. At present the G.P.O. is seeking the Borough Council's permission to erect 14 street call boxes at Hackney.—*Evening News.*

Radio Notes.

A New Loud-Speaker.—Toplis Duplex.—Last week we had the pleasure of examining and listening to a new telephone receiver, the invention of Mr. L. G. Toplis, in the presence of Capt. West, at the Savoy Hill studio of the B.B. Co. This hornless device, which we hope to describe in the near future, is an attempt to retain the virtues of an ordinary "loud-speaker," and, at the same time, eliminate the inherent drawbacks of a horn. The instrument is simple in construction, and gives promise of good results being obtained from the commercial model when it is placed upon the market.

Denmark.—New Meteorological Station.—The Commercial Secretary at Copenhagen has informed the Department of Overseas Trade that since the Danish Meteorological Institute again this summer began to issue weather forecasts by wireless for the benefit of farmers, it has been strongly urged that a transmitting station be established for the use of the Institute alone; the total cost of the plant would be about 15,000 kroner. If the weather service is to be extended and modernised, Lyngby Station, the one at present being used for this purpose, would be inadequate.

New Station.—Nottingham.—A new broadcasting station was opened at Nottingham by the B.B. Co. on September 16th. The call signal is 5 NG, and the wavelength 340 metres.

Northern Ireland.—Belfast.—The broadcasting station built at Belfast by the British Broadcasting Co., Ltd., was formally inaugurated on September 15th. It is a main station, with the call signal 2 BE and a wavelength of 435 metres.

South Africa.—Another Station.—The erection of a radio broadcasting station at Port Elizabeth is under discussion. According to the *British S.A. Export Gazette*, it is probable that private enterprise will control the undertaking. Receiving sets to the value of approximately £20,000 were sold in and around Johannesburg during the three months ended August 31st.

Cape Town Station.—The Cape Town broadcasting station was to be officially opened on September 15th by Mr. Boydell, Minister of Posts and Telegraphs. The British Broadcasting Co. was to endeavour to relay the Cape Town programme to Great Britain.—*Reuter.*

The wavelength is 375 metres, the call sign being "WAMG." Both as regards the arrangement of the studio and the apparatus employed, the London station has been taken as a model. The installation consists of a Marconi 6-kW transmitter and microphone such as are used in six of the British main stations, and at Belfast, Brussels, Durban, Rome, Rio de Janeiro, and Lima. It is expected that a similar station will shortly be erected in Sweden. The Cape Town station is situated at Stuttafords, a departmental store in Adderley Street, and is controlled by the Cape Peninsula Publicity Association. Mr. King, of the British Broadcasting Co., has gone to Cape Town as musical director, and Mr. Thomas, a Marconi engineer, is in charge of the technical side of the station. The Durban station, which is similarly equipped with Marconi apparatus, is expected to open in November.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—Melbourne.—December 1st. State Electricity Commission. 66,000-V transformers, induction regulators and accessories for the Yallourn power scheme. (September 5th.)

November 24th. 22,000-V cable and accessories for the Yallourn power scheme. (September 12th.)

Newcastle (N.S. Wales.)—November 25th. Caledonian Collieries, Ltd. Turbo-alternators, condensers, pumps, boilers, pipework, superheaters, chimney, fans, switchboards, transformers, &c. (September 12th.)

Commonwealth Postmaster-General's Department.—October 7th. Lamps, lamp caps and sockets, and protective apparatus.

October 14th. Bells and buzzers.

November 11th. Switchboards, cord types, and spare parts.

November 18th. Transmitters, receivers, &c.

New South Wales.—January 29th, 1925. Postmaster-General's Department. Automatic c.b. telephone equipment for the offices of the Ministry of Public Works.

Sydney.—October 29th. N.S. Wales Government Railways and Tramways. Two electric storage batteries for signal operating, and two battery-charging motor generators.*

November 5th. Three 12.5-kW and one 20-kW motor-generator sets.

November 19th. Switch-operating and lighting batteries. Chief electrical engineer, 61, Hunter Street, Sydney.

Victoria.—November 26th. Melbourne and Metropolitan Tramway Board. Automatic sub-station equipment.

Postmaster-General's Department. October 7th. Protective apparatus.

October 14th. Bells and buzzers.

November 11th. Switchboards.

—*Reuter's Trade Service* (Melbourne).

Belgium.—September 24th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels, are inviting tenders for the supply of 3 km. of 63-conductor telephone cable. Particulars (Cahier des Charges Special No. 3-57) for 2.50 fr.

Buenos Aires.—October 6th. Supply of machinery and equipment for a hydro-electric station to be built at the city of Mendoza for the supply of current to the works connected with the building of a tunnel across the Precordillera. Particulars from the Direction Technique, 1840, Calle Charcas, Buenos Aires.

Bradford.—October 16th. Corporation. One 500-kW automatic converting plant and switchgear; and four traction feeder panels. (See this issue.)

Christiania.—September 27th. Norsk Howd Railway. Nine electric locomotives.

Corfu.—September 28th. Port Authorities. Installation of electric lighting plant at the Port, or, alternatively, for the supply of electricity, including the laying of mains, &c. Particulars from M. le Vice-President de la Commission Executive du Port, Corfu.

Dublin.—September 29th. Electric lighting installation at Ship Street and Clock Tower Government Buildings, Dublin Castle. Specifications from Mr. J. J. Healey, secretary, Office of Public Works.

Dundee.—October 20th. Electricity Department. One 12,500-kW turbo-alternator set and condensing plant. (See this issue.)

Eccles.—September 22nd. Electricity Committee. One 150-kVA, 3-phase, 50-cycle, 6,600/400-V oil-cooled transformer. Specification and form of tender from Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Edinburgh.—October 13th. Corporation Electricity Department. Two 65/80,000-lb. water-tube boilers, with economisers, pulverised fuel plant, &c., for the Portobello station. (See this issue.)

Egypt.—CAIRO.—Egyptian State Railways and Telephones. Unarmoured cable. (September 5th.)

Glasgow.—October 4th. Corporation Electricity Department. Various works in connection with the extension of the Dalmarnock generating station. Forms from the engineer; tenders to Town Clerk.

India.—September 26th. India Store Department, Belvedere Road, S.E. Punkah motors. (September 12th.)

BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY CO.—October 13th. Track bonds. (See this issue.)

Littleborough.—September 27th. Electric lighting installation in Parish Church. Specifications, &c., from Rev. A. F. Gaskell, The Vicarage.

London.—ISLINGTON.—October 17th. Electricity Department. Water-tube boiler, with oil fuel installation, draught system, flues, steam piping, &c., and the dismantling and removal of four water-tube boilers. (September 5th.)

H.M. OFFICE OF WORKS.—September 22nd. 900 prepayment electricity meters. (September 12th.)

SOUTHWARK.—October 1st. Electricity Department. Cables for 12 months. (September 5th.)

METROPOLITAN ASYLUMS BOARD.—October 8th. Installation of an internal automatic telephone system at Leavesden Mental Hospital, King's Langley; and the installation of a C.B. telephone system at Brook Fever Hospital, Shooter's Hill, S.E. (September 12th.)

Manchester.—September 22nd. Electricity Committee. Three-phase, 6,600-V sub-station switchgear. Specifications and form of tender from Mr. S. L. Pearce, manager, Electricity Department, Town Hall.

September 24th. Board of Guardians. Electric lamps required during the year commencing October 1st. Form of tender from Mr. J. Macdonald, clerk to Board, Union Offices, All Saints', Manchester.

New Zealand.—NEW PLYMOUTH.—October 22nd. Harbour Board. Three electric capstans, &c.*

GREY ELECTRIC POWER BOARD. November 14th. Steam-driven generating plant.*

PUBLIC WORKS DEPARTMENT.—October 28th. Lake Coleridge Scheme. Switchboard, 6,600-V oil switches, &c.—*Tenders.*

Rosslynlee.—September 27th. Midlothian and Peebles District Asylum. Supply of various articles, including electrical fittings, &c. Forms from clerk and treasurer, 19, Heriot Row, Edinburgh.

Spain.—MADRID.—The Ministro de Fomento. Electrification of the third section of the railway line between Lerida and Saint Girons at an estimated cost of 8,078,950 pesetas. For particulars apply to the Excmo Señor Director-General de Obras Públicas, Madrid.

Stockport. — Electricity Department. One 12,000-kW turbo-alternator, complete with surface condenser, pumps, &c. (September 12th.)

Switzerland.—September 27th. The Swiss State Railway authorities in Berne. Installation at the Vernayoz power station of three 11,000-kVA, 15,000/66,000-V single-phase transformers; three 15,000/132,000-V, single-phase transformers, and the necessary switchgear, measuring and recording instruments. Particulars for 10 fr. from the Abtheilung für Elektrifizierung, Dienstgebaude, Bureau 164, 43, Mittelstrasse, Berne.

Turkey. — CONSTANTINOPLE. — October 2nd-November 9th. Posts and Telegraphs Department. 4,500 kilos bronze wire.*

November 4th. 100 large and 500 small voltmeters.*

Twickenham.—September 24th. Urban District Council. Supply and installation of an 8-h.p. crude oil engine and 50/70-V generator; and alterations to switchboard, &c. (See this issue.)

Whitworth (near Rochdale).—Electric lighting installation at the Reform Club. Form and specifications from the secretary.

West Ham.—September 20th. Electricity Department. One 10,000-kW turbo-alternator, one 10,000-kW surface condensing plant, three water-tube boilers, superheaters, &c., or, alternatively, a complete scheme, including alternator, condensing plant, water-tube boilers, &c., with other auxiliary plant, pipework, &c. (September 5th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—

Extension of the Rubislaw electricity sub-station.—Geo. Bisset & Son.

Barnes.—Fire Brigade and Lighting Committee. Accepted:—

1 mile .10 by .10 by .03 sq. in. 3-core cable (£656); 200 yd. 4 core .2 by .2 by .1 by .01 sq. in. (£126).—Macintosh Cable Co.

Australia.—VICTORIA.—Government Railways.

Copper cable and contact wire (£2,606).—British Insulated & Helsby Cables, Ltd.

NEW SOUTH WALES.—Government Railways and Tramways.

Two constant-current transformers (£419).—Australian Westinghouse Co., Ltd.

Steam pipes for White Bay power house (£4,781).—Stewarts & Lloyds, Ltd.

Three 50-cycle transformers (£2,602).—English Electric Co.

TASMANIA.—Hobart City Council.

Three motor equipments, including oil and lightning arresters, manufactured by the British Thomson-Houston Co. (£2,944).—Oliver and Oliver Pty. —*Tenders.*

Batley.—Corporation.

Motor converter (£3,410).—Bruce Peebles & Co., Ltd.

Carlisle.—City Council. Accepted:—

Construction of the foundations of the new power station.—Ormerod & Son.

Dewsbury.—Town Council.

Electric lighting installations at houses in Wakefield Road (£380).—W. Angus.

Glasgow.—Tramways Committee. Recommended:—

Air brakes.—Westinghouse Brake and Saxby Signal Co., Ltd.
Copper trolley wire.—Thomas Bolton & Sons, Ltd.
Section pillar castings.—James Allen, Senr., & Son, Ltd.

Corporation. Recommended:—

Automatic intercommunicating telephone system for the City Assessor's Department (£229).—Dictograph Telephones, Ltd.

London.—GENERAL POST OFFICE.—Accepted:—

12 months' supplies of metal-filament, vacuum, gasfilled, and carbon-filament lamps.—General Electric Co., Ltd.

H.M. OFFICE OF WORKS. Accepted:—

12 months' supplies of metal-filament, vacuum, gasfilled, and carbon-filament lamps.—General Electric Co., Ltd.

Penarth.—GREAT WESTERN RAILWAY CO.

Renewal of the electric lighting installation at Penarth Docks.—W. E. O. Williams & Co.

Portsmouth.—Town Council.

Installation of fire alarms (£2,400) and telephones (£1,493).—G. Longfield-Beasley.

South Africa.—JOHANNESBURG.—Municipal Council. Accepted:—

Trolley wire (£585).—Telegraph Manufacturing Co. (Colonial).
Cut-outs.—W. T. Henleys (S.A.) Telegraph Works Co., Ltd. (£533). Telegraph Manufacturing Co. (Colonial) (£63).
1,000 primary fuses and plugs (£362); 11,200 lb. joint box compound (£167).—H. Davies & Co.
2,000 lb. black adhesive tape (£169).—Siemens Bros. & Co., Ltd.
Oil switches (£242).—Metropolitan-Vickers Electrical Co., Ltd.
2,500 porcelain suspension fittings (£354).—Rand Electrical Co.
1,500 enamelled steel street-lighting fittings (£744); 4,000 240-V, 200-watt, gasfilled lamps (£583); 2,000 240-V, 300-watt gasfilled lamps (£292).—H. Davies & Co.
15,000 210-V, 60-watt lamps (£437); 4,000 240-V, 100-watt gasfilled lamps (£317); 5,000 210-V, gasfilled lamps (£396).—British General Electric Co., Ltd.
Two 1,000-kW rotary converters, complete with switchgear and instruments (£6,280); spares (£457); one 750-kW rotary converter, with switchgear, &c. (£2,827); spares (£378).—British General Electric Co., Ltd.—*S.A. Power Engineer.*

Southend-on-Sea.—Education Committee.

Electric lighting installation at North Street Schools, Leigh (£130).—F. M. Burley & Co.

Forthcoming Events.

Radio Society of Great Britain.—Wednesday, September 24th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Presidential address by Prof. W. H. Eccles, F.R.S.

Institution of Locomotive Engineers.—Thursday, September 25th. At the Engineers' Club, Coventry Street. Paper on "The Main-line Electrification on British Railways," by Lieut.-Col. O'Brien, D.S.O.

E.D.A. Salesmanship Conference (London Area).—Friday, September 26th. At the E.L.M.A. Lighting Demonstration Department, 15, Savoy Street, Strand. At 7.30 p.m. Paper on "A Programme for Intensive Lighting Development," by Mr. W. E. Bush.

All-British Wireless Exhibition.—September 27th to October 8th. At the Royal Albert Hall, London.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to know the names of makers or suppliers of:—

ACFIL pumps.
WOOLBROUGH accumulators.
Padlocks with paper seals for prepayment meters.
Sand-papering machines for finishing small wooden articles.

Notes.

Export of Energy from Switzerland.—The Swiss Federal Council has sanctioned a decree with regard to the export of electrical energy, the delivery of which from Swiss hydro-electric works to other countries is rendered subject to the approval of the Federal Council, and is placed under the control of the Federal authorities. Applications for the grant of export permits or for an alteration or renewal of existing licences have to be made to the Confederation Board for Water Economy. A commission of five members, two of whom will represent producers and two consumers, is to be appointed to report on applications for permits and questions connected with them, and the length of the permits as a rule will not exceed 20 years.

Appointments Vacant.—Consumers' Engineer (£304) for the Stepney Corporation Electricity Department. Assistant mechanical and electrical engineer (Rs. 500 per month) for the Madras Port Trust. Assistant electrical engineer (525/675 rupees per mensem) for the Madras & Southern Mahratta Railway. (See our advertisement pages to-day.)

R.A.F. Cadetships.—An examination of candidates for Cadetships in the Royal Air Force, about 35 in number, will be held on November 18th. Applications must be sent in by October 2nd. Full particulars are obtainable from the Secretary, Air Ministry, or from Air Publication No. 121, which is procurable from the Stationery Office (1s. net).

Probationary Inspectors, Engineering Dept., G.P.O.—It is announced in our advertisement pages that the latest date for the receipt of entries for the examination in connection with these appointments is November 20th.

Summer Time Ends.—Summer time will end and normal G.m.t. be restored at 3 a.m. on Sunday next, September 21st, when all timepieces should be put back to 2 a.m.

Educational.—ACTON AND CHISWICK POLYTECHNIC.—The Mechanical and Electrical Engineering Department announces in our advertisement columns that four-year evening courses commence on September 29th.

Wind-driven Generators at Wembley.—In our mention of the exhibit of the Lambert Engineering Co. at the British Empire Exhibition in our last issue (p. 390) we incorrectly stated that this firm's wind-driven generating plant was situated at the Electric Farm. The plant at the farm was made by the Glasgow Electrical Engineering Co., Ltd.; the Lambert set is a short distance away.

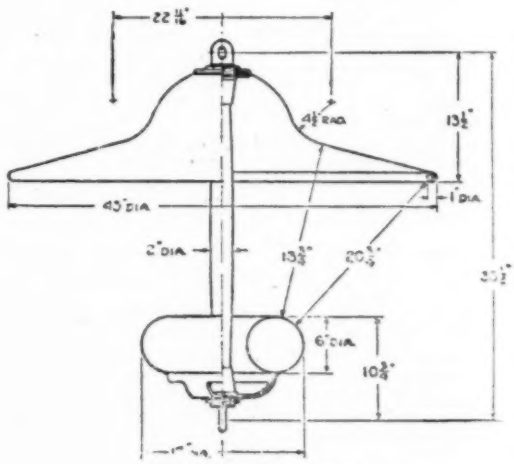
Opening of Torquay's Power Station.—The opening ceremony of Torquay's new power station at Newton Abbot, which is described elsewhere in this issue, took place on September 16th, the visitors meeting at the Town Hall and inspecting the new receiving sub-station at Torquay. The party then proceeded by cars to the Newton Abbot power station, where the visitors were received by Dr. G. M. Winter (Deputy Mayor), who explained that the Mayor had been taken ill and could not attend. Sir John Snell, Chief Electricity Commissioner, congratulated the Councils of Newton Abbot and Torquay on their statesmanlike action in adopting a joint station. He unveiled a tablet commemorating the opening if the station, after which the party proceeded into the power house, where Mrs. John Taylor started up the new set. The company then returned to the Town Hall at Torquay for luncheon. Sir John Snell, in proposing prosperity to the Torquay undertaking, pointed out the remarkable strategic position occupied by the new station which he felt must inevitably grow and be the source of supply for many of the surrounding towns. At the conclusion of the lunch Mr. J. P. Gregory (B.T.-H. Co.) presented on behalf of a few friends a wristlet watch to Mrs. John Taylor, a fountain pen to Alderman Taylor (Chairman of Electricity Committee), and a cigarette case to Mr. H. F. G. Woods, borough electrical engineer and manager.

Electrical Manometers.—In the course of a paper on "The Measurement of Pressure" which he read at the Institute of Marine Engineers, Mr. J. L. Hodgson, B.Sc., pointed out that instruments based on a change of electrical properties when subjected to pressure are not generally known to engineers. He describes them in his paper as indicating starting points from which new departures may be made. One feature common to all such instruments is that their inertia effects are very small; they are therefore suitable for measuring very rapidly varying pressures.

Electrical resistance manometers depend upon the change of electrical resistance of various substances, such as carbon, mercury, manganin, and platinum, when subjected to pressure. Each instrument in which mercury is used has to be calibrated against known standards. The change of resistance of manganin wire with pressure is not very constant for different samples, its variation depending upon the previous history of the sample. The behaviour of platinum, on the other hand, is very uniform. When the change of resistance with pressure is being measured, the apparatus must be kept at constant temperature, or alternatively changes in resistance due to temperature must be compensated for. This method does not lend itself to the measurement of small pressures.

In piezo-electric manometers the difference of potential produced is proportional to the pressure applied to the crystal. In an apparatus suggested by Sir J. J. Thompson and developed by Dr. D. A. Keys, the difference of potential is caused to deflect a beam of charged cathode rays which impinges on a photographic plate and so records itself. The deflection of the beam is directly proportional to the pressure applied to the crystal. One ten thousandth part of a second is sufficient for a record to be obtained. The method is suitable for measuring explosion or any rapidly varying pressures. In somewhat similar apparatus developed by Mr. J. C. Karcher, a small condenser made of quartz plates and platinum foil constitutes the pressure gauge. It is subjected to the pressure of a plunger communicating with the power chamber of the gun, and is connected to the terminals of a ballistic galvanometer. The image of a lamp filament reflected by the galvanometer mirror is focused on a rapidly-moving film in a recording camera, and time-lines 0.001 second apart are obtained on the film by means of a parallel beam of light reflected by the mirror of a Duddell oscillograph element tuned to a frequency of 500 cycles per second and actuated by current supplied from the circuit of a vacuum-tube-driven tuning fork. The angular velocity of the mirror is proportional to the pressure; the pressure is therefore proportional to the tangent of the angle of the slope of the curve obtained on the photograph. Calibration is effected by subjecting the pressure gauge to a known load in a testing machine and observing the ballistic throw of the galvanometer, or the angle of slope of the curve obtained on a photographic record, when the load is released suddenly.

A New Suspension Insulator.—The conditions under which a new suspension insulator has been experimentally developed for use on very-high-voltage transmission lines carrying large power are outlined by Prof. H. B. Smith, of the Worcester Polytechnic Institute, Mass., U.S.A., in the August *Journal* of the A.I.E.E. It consists of metallic terminal members to distribute the electric flux and an insulating impregnated wood (or other material) mechanical strain member, concentric with the hollow electric field produced between the metallic terminal members. The unit described is designed for use on 110,000-volt power lines, two similar units in series for 220,000-volt lines, and three units in series on 330,000-volt lines. Streamers or arcs do not form along the spindle, nor can one be blown upon it by strong air currents. The accompanying illustration shows the shape and dimensions of the insulator, the test values of which range about 280 kV, or



A New Suspension Insulator.

over, when dry, and 200 kV, or over, under standard wet spray test per unit. No corona is visible on any part of the insulator until within about 5 per cent. of the breakdown voltage. Two units in series require about 500 kV when dry, or 350 kV when wet, for breakdown, which values are without capacity modification which could be readily secured to improve the values. Mr. H. C. P. Weber, of the Westinghouse Research Laboratories, has been engaged in the development of impregnated and treated wood spindles for use in this insulator. His results are such that, with absence of corona and arcing conditions on the surface of the insulating member, there is definite promise of an insulating strain member being produced with satisfactory dielectric properties and mechanical properties far superior to those of any porcelain yet available. Artificial ageing and weathering tests of great severity accompanied by repeated electrical tests, extending over a number of months, have been applied to the spindles.

Whitworth Scholarship Awards.—The Board of Education announces the following successes, among others, in the recent Whitworth Scholarship examinations:—S. W. C. Pack and W. Ford, electrical fitter apprentices at Portsmouth Dockyard. The following electrical fitter apprentices received Whitworth Prizes, valued at £10 each:—J. Donegan, W. H. Cleaves, W. H. Hammett, R. J. Stafford, H. M. Pittaway, and A. W. Trethewy, of Devonport; R. A. Yeo and F. J. Tanner, of Portsmouth; A. C. G. Canton, of Pembroke Dock; and F. B. Masson, of Chatham.

Permanent Electric Truck Show in New York.—A permanent exhibit of electric trucks has been opened at New York by the New York Edison Company. Leading manufacturers of electric street trucks, industrial trucks, storage batteries, charging equipment and accessories are among the exhibitors.—*Reuter's Trade Service* (New York).

Fatality.—At the Preston electricity station recently, James Thompson was struck by part of a transformer which he was helping to unload. The transformer had been lifted from a float by a chain hoist and placed on two small trucks. Thompson was helping to push the transformer into the works, when one of the wheels struck an obstruction and tipped the load forward. Thompson lost his balance, and fell with his head beneath the transformer. He received terrible injuries, and died on his way to the infirmary.

Institution Notes.

Institution of Public Lighting Engineers.—ANNUAL CONFERENCE.—The Institution of Public Lighting Engineers and Superintendents held its annual conference in Glasgow on September 16th and 17th. On the opening day the delegates were accorded a civic reception and entertained to luncheon in the City Chambers. The president, Mr. S. B. Langlands, Glasgow Public Lighting Superintendent, delivered his presidential address, and among the authors of papers read during the conference were Mr. T. H. Harrison, Mr. E. J. Stewart, and Mr. R. B. Mitchell. A trip to Edinburgh took place on the 18th, the programme there including a civic reception and luncheon.

Mining Electrical Engineers.—ANNUAL MEETING.—The South Wales Branch of the Association of Mining Electrical Engineers, at the annual meeting on Saturday, at Cardiff, had the importance of electrical plant at collieries as an aid to the economical and increased production of coal emphasised by the new chairman, Mr. Idris Jones, A.M.I.E.E., of Bargoed, who took as an example the practice of the Powell Duffryn Co.'s electrical system, with which he himself was connected. Mr. Theodore Stretton, whom he had succeeded in the chair, was president-designate of the Association. Mr. A. G. Brown, general manager of the Great Western Colliery Co., Ltd., presented certificates to the following successful candidates in the recent Association examination:—Messrs. Harry Benson, Aberaman; David G. Davies, Swansea; Llew Henry Day, Dynvant; Thomas John Howells, Swansea; John James, Merthyr; Cecil Peregrine Jones, Glanamman; Horace Short, Newport; and Daniel John Williams, Swansea. Mr. Brown said that those responsible for the supervision of collieries realised more and more the need for really good engineers in the electrical department, as it was to the machinery in that department that they looked to a great extent for maintaining and increasing the output of coal. It was very creditable to South Wales that out of 25 who passed the examination, which covered the whole of the United Kingdom, eight came from that branch. Major E. J. David, M.I.E.E., chief electrical engineer of the Powell Duffryn Co., Ltd., further emphasised that the installation of up-to-date electrical plant helped materially in the economical production of coal.

Radio Society of Great Britain.—AUTUMN ADDRESS.—The autumn presidential address to members of the Society will be delivered by Prof. W. H. Eccles, D.Sc., F.R.S., at the Institution of Electrical Engineers, Savoy Place, at 6 p.m. on September 24th, on which occasion the president will deal with the latest developments of the position of the scientific amateur under the wireless telegraphy regulations.

Engineering Societies.—CONFERENCE.—At the Conference of Engineering Societies convened by the Society of Engineers at the British Empire Exhibition on September 15th, Mr. Yorath Lewis delivered a short lecture on the "Never-stop Railway," which is electrically driven, and which was afterwards inspected under the guidance of Capt. F. Shelford. Mr. Lewis stated that the railway had carried 70,000 passengers, and each of the 85 cars had run 3,500 miles, while the driving spirals had made over four million revolutions.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. GEORGE SMITH, after 25 years on the staff of the London United Tramways, Ltd., has resigned his position as inspector, and has been presented by his colleagues with a gold watch and medallion.

The marriage took place on September 6th, at Shepherd's Bush, London, W., of Mr. LAURENCE EDWARD WHITE, mains engineer with Callender's Cable & Construction Co., Ltd., at Leeds, and Miss ETHEL IRENE BRIDGES.

Mr. BURROWS, for some time a teacher at the Fife Mining School, Cowdenbeath, and who left that institution to take up duty in the High Tension Department of the Hydro-Electric Power Commission at Niagara Falls, has been appointed teacher of electrical engineering in the Central Technical School, Toronto.

The Belfast Corporation Tramways Committee has decided to advertise for a new manager and engineer for the tramway undertaking. The decision was arrived at at a special meeting of the Committee, lasting for over two hours, when it was decided to recommend the Council to advertise for a new manager and engineer, and appoint Mr. CARLISLE, the present chief of the department, assistant manager at his present salary. It is understood that Mr. Carlisle is prepared to accept this arrangement.

The marriage took place at Dewsbury, on September 2nd, of Mr. ARTHUR BEVAN, a member of the staff of the Yorkshire Electric Power Co., Ltd., and Miss CONSTANCE MAXWELL, of Ravensthorpe.

At a recent meeting of the East Ham Corporation electricity department and tramway staffs, Mr. W. C. ULLMAN, who is retiring from the position of engineer and manager of the combined undertakings owing to ill-health, was presented with a gold watch. Mrs. Ullman received a handsome bottle of perfume at the same time. Mr. W. R. Elliott, the deputy engineer and manager, presided at the meeting, and the chairman and vice-chairman of the Electric Lighting and Tramways Committee, the traffic superintendent, and the chief clerk testified to the cordial relations which existed between Mr. Ullman and those working with him. In returning thanks for the presents, Mr. Ullman announced his intention of taking a trip to Australia to recruit his health; he had taken a "return ticket." An album of photographs of the members of the East Ham Borough Officers' Association, and a case of pipes were presented to Mr. Ullman at a tea and concert held by the Association. Mr. Ullman has been with the East Ham Council for 25 years.

Mr. A. G. A. BONNY, late of the Newcastle Electric Supply Co., sailed for Brazil on 16th instant to take up an appointment with the Pará Electric Railway and Lighting Co., Ltd., as distribution engineer.

Mr. W. E. ROBERTS, general manager of the Hong-Kong Tramways Co., was to arrive at Southampton on the Canadian Pacific liner, *Empress of France*, on September 17th.

Obituary.—MR. R. BRYSON.—The death occurred, suddenly, on August 30th, at the age of 60 years, of Mr. Robert Bryson, senior traffic inspector of the Ayr Corporation tramways. He entered the service of the Corporation when the tramways were inaugurated in 1902.

New Companies Registered.

Wirgraphone, Ltd. (200,341).—Private company. Registered September 10th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, assemblers and distributors of electrical, medico-electrical, and wireless electric parts of any kind, &c. The subscribers (each with one share) are:—C. Manning, 47, Pollard Lane, Bradford, manager; T. L. Preston, 55, Pollard Lane, Bradford, toy salesman. The first directors are to be appointed at the first meeting of the company. C. Manning signs as manager. Qualification, £1. Solicitors: Gaukroger and Dowling, 5, Bond Street, Bradford. Registered office: 69a, Carlisle Road, Bradford.

Friho Manufacturing Co., Ltd. (200,280).—Private company. Registered September 6th. Capital, £2,000 in £1 shares. To carry on the business of scientific instrument makers, mechanical and electrical or automobile engineers; to establish, manage, and control works for the manufacture and supply of medical, surgical, and optical instruments and appliances, electrical instruments and apparatus for wireless telephones and telegraphs, &c. The provisional directors are:—H. A. Giers, 51, Tierney Road, Streatham Hill, S.W., merchant; W. Porter, 2, Neville Croft, Warwick Road, New Barnet, Herts., accountant.

W. & A. Smith (Glasgow), Ltd. (13,314).—Private company. Registered in Edinburgh on September 6th. Capital, £500 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers and repairers of electric motors, dynamos, motor generators, &c. The subscribers (each with one share) are:—A. C. D. Smith, 236, Argyle Street, Glasgow, mechanical engineer; W. Yuill, 236, Argyle Street, Glasgow, salesman. The first directors are not named. Secretary: John McNicol. Registered office: 59, Bath Street, Glasgow.

Northern Electric Lamp and Accessories, Ltd. (200,264).—Private company. Registered September 5th. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer and factor carried on by W. Brittain under the style or firm of successors, Frank Rawcliffe & Co., at 79, Westgate Road, Newcastle-upon-Tyne. The directors are:—J. G. Hughes, 103, Thomas Street, Merthyr Tydfil, engineer; Mrs. F. E. Brittain, 6, East Avenue, Benton, Northumberland (permanent). Qualification, 1 share.

Paton & Wood, Ltd. (200,375).—Private company. Registered September 12th. Capital, £2,000 in £1 shares. To acquire the business of consulting engineers, contractors and agents carried on by Paton & Wood at 25, Market Street, Manchester. The directors are:—J. D. Paton, "Glenmuir," Leicester Road, Hale; A. Wood, 72, Windsor Road, Oldham (both permanent, subject to holding 400 shares). Qualification, 2 shares. Secretary: A. Wood. Registered office: 25, Market Street, Manchester.

Marpole & Bond, Ltd. (200,390).—Private company. Registered September 12th. Capital, £500 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, and all kinds of electrical and advertising signs or advertisements, &c. The directors are:—F. Marpole, River Cottage, Shepperton, engineer (managing director, Marpole and Frisby, Ltd.); C. D. Bond, "Runnymede," Charlton Road, Shepperton-on-Thames, engineer (proprietor of Charles Bond & Son, electrical metal manufacturers). Solicitor: F. F. Annear, Essex Chambers, Clarendon Road, Watford. Registered office: River Cottage, Shepperton-on-Thames.

Dalbeattie Electric Light and Power Co., Ltd. (13,318).—Registered in Edinburgh on September 11th. Capital, £5,000 in £1 shares. To take over the business of an electric light and power company carried on by J. A. M. Brown, J. K. W. B. Morgan, and H. Brown, Junr., at the Barrhill Works, Dalbeattie. The first directors are:—J. H. W. B. Morgan, "Tayvahock," Baillieston, Lanarkshire, engineer; H. Brown, Junr., 7, May Terrace, Mount Florida, Glasgow, engineer; J. Adam Mackay Brown, 7, May Terrace, Mount Florida, Glasgow; J. Edwin Milligan, Dalbeattie, solicitor; J. Carswell, Barbridge House, Dalbeattie. Qualification, 50 shares. Secretary: S. T. Austin. Registered office: 21, High Street, Dalbeattie.

Official Returns of Electrical Companies.

Amesbury Electric Light and General Supply Co., Ltd.—Particulars filed of £1,000 debentures authorised August 25th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital; the whole amount now being issued, and ranking *pari passu* with £2,500 debentures issued pursuant to resolution dated December 27th, 1922.

Refty Electrical Appliances, Ltd. — Debenture dated August 20th, 1924, to secure all moneys not exceeding £500 now or hereafter owing, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: Davis and Timmins, Ltd., 34a, York Road, King's Cross.

Telephone Manufacturing Co., Ltd. — Mortgage and charge on 40, Martell Road, and Hollingsworth Works, Martell Road, Lambeth, machinery and fixtures, &c., thereon and on the company's undertaking and property, present and future, including uncalled capital. Also land registry charge on 40, Martell Road, Lambeth; and land registry charge on the above mentioned works, all dated August 19th, 1924, to secure all moneys due or to become due from the company to the Midland Bank, Ltd. respectively.

G. Davenport (Wireless), Ltd.—Particulars filed of £3,000 debentures authorised July 22nd, 1924, charged on the company's undertaking and property, present and future, the amount of the present issue being £1,750.

Salcombe Gas and Electricity Co., Ltd.—Four mortgages on certain properties in Devonshire, all dated August 21st, 1924, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £500, £2,000, £100 and £100 respectively.

English Electric Co., Ltd.—Conveyance dated August 21st, 1924 (supplemental to trust deed dated September 15th, 1919, securing £1,000,000 5 per cent. sinking fund first mortgage debentures), charged on certain freehold properties, &c., at Bradford. Trustees:—Debenture Corporation, Ltd., Worcester House, Walbrook, E.C.

Bucks Electric Wire and Engineering Co., Ltd.—Debenture constituting a floating charge on the company's undertaking and property, present and future, including uncalled capital, dated August 28th, 1924, to secure £500. Holder: A. Bullard, Tyleford Lodge, Newport Pagnell, Bucks.

Electrical Specialities Co., Ltd.—F. C. Young, of Bank Street, Sheffield, was appointed receiver on September 3rd, 1924, under powers contained in debenture dated January 28th, 1922.

Coates & Co. (Sheffield), Ltd.—F. C. Young, of Bank Street, Sheffield, was appointed receiver and manager on August 29th, 1924, under powers contained in debentures dated June 9th, 1922.

Phonopore Construction Co., Ltd.—Miss I. M. Robinson, of 17, Esmond Gardens, South Parade, Bedford Park, W.4, was appointed receiver and manager on September 4th, 1924, under powers contained in debentures registered June 18th, 1917. F. R. H. Robinson, c/o Phonopore Works, Scott's Road, Southall, former receiver and manager, ceased to act in those capacities on the above-mentioned date.

Bude Electric Supply Co., Ltd. (95,137).—Return dated June 7th, 1924. Capital, £15,000 in £1 shares. 10,000 shares taken up. £10,000 paid. Mortgages and charges, £2,500 mortgage debentures.

Wycombe (Borough) Electric Light & Power Co., Ltd. (53,133).—Return dated April 22nd, 1924. Capital, £75,000 in 10,000 ordinary and 5,000 preference shares of £5 each. 3,000 preference and 10,000 ordinary shares taken up. £65,000 paid. Mortgages and charges, £40,000.

Welco Patents, Ltd. (188,612).—Return dated September 7th, 1924. Capital, £1,000 in £1 shares. 448 shares taken up. £30 paid. £418 considered as paid. Mortgages and charges, £210.

Second debenture dated August 29th, 1924, to secure £150, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: H. Jessop, 190, Aston Lane, Perry Barr, Birmingham.

Van Raden & Co., Ltd.—Satisfaction in full on August 23rd, 1919, (a) of debenture dated July 18th, 1904, securing £1,500; and (b) of debenture dated October 8th, 1907, securing £1,250. (Notices filed August 23rd, 1924.)

Mills, English & Co., Ltd.—Satisfaction to the extent of £5,000 on July 30th, 1923, of debenture dated November 23rd, 1904, securing £8,000.

City Notes.

Chadburn's (Ship) Telegraph Co., Ltd.

The annual meeting was held on September 9th, under the chairmanship of Mr. William Chadburn. In presenting the report and accounts, which were abstracted in our issue of September 5th (p. 371), the chairman said that against the reduction in the amount of cash at bankers and in hand must be set the investment of £25,000. It was only by the most strenuous efforts that the results had not been worse than those of the previous year. The curtailment of naval "programmes" had been an adverse factor, and numerous strikes had resulted in the loss of many months' mercantile work. Although the gross profit had fallen considerably the work undertaken was, if anything, in excess of that carried out in the previous year. Although as a profit-making concern the company was in a difficult position, there could be no question regarding its sound financial state.

Ferranti, Ltd.

The nineteenth annual general meeting was held on September 11th; Mr. A. W. Tait, C.B.E. (chairman), presided. The Chairman, in presenting the report and accounts (*vide* ELEC. REV., September 5th, p. 371), said that the turnover for 1923-24 showed a substantial increase over that of the previous year, and all the departments of the company's business had contributed to that increase. With regard to the meter department, there had been an increase in quantity and value. The power transformer business had shown a satisfactory increase during the year, the output during the period having been practically double that of the previous year, and they hoped and believed that this would still further increase, particularly in foreign markets. The results shown by the foundry were also satisfactory, and there was an encouraging increase in output in iron and non-magnetic castings. It was satisfactory to note that the interest on debenture stock had steadily decreased owing to the gradual redemption of the amount outstanding. They had, as usual, transferred the sum of £10,000 to depreciation reserve account, and the net balance carried to the balance sheet was £55,545, as against £36,362. The balance sheet reflected the improved financial position of the company. There was a small increase in the value of plant, machinery and tools, such as would naturally be expected in a progressive business. Stocks and stores showed an increase of approximately £43,000, and sundry debtors an increase of £14,000 and both these items reflected the substantial increase in the company's turnover during the year. Depreciation reserve, in consequence of £10,000 charged against the trading of the year, now stood at the substantial figure of £76,912. A sum of £35,000 had been transferred to general reserve, increasing the amount of that account to £125,000. Last year they commenced the practice of paying the preference dividends half-yearly, and he hoped that they would be able to continue that practice. The improvement in the company's financial position in recent years was shown by the steady reduction of mortgage and other indebtedness and the gradual increase of liquid assets as compared with current liabilities. They started the current year with a satisfactory order book, and the orders which had been received up to date and the output of the works were encouraging. While business in the export markets was extremely difficult and competition very keen, they hoped that they would obtain their share, and, unless unforeseen difficulties arose, they were hopeful of being able to present an equally satisfactory account next year. Dr. S. Z. de Ferranti seconded the resolution, which was carried.

Brown, Boveri and Co.

The report of this undertaking, which it is proposed to reconstruct in consequence of losses, explains the causes of the latter in the following manner: With the crisis beginning in 1920, the company first experienced considerable losses on raw materials and finished and partly finished products; the degree of activity diminished and prices fell. The surpluses on manufacturing were 12.5 million fr. in 1920, 9.06 millions in 1920-21, 8.70 in 1921-22, 5.98 in 1922-23, and 3.56 millions in 1923-24. The results in the last year did not even suffice to cover the general expenses of the works. In addition, large losses were incurred in the same years on the participations in the "Secheron" and "Scintilla" concerns. The "Scintilla" of Solothurn is a war-time creation, through which the manufacturing of the company was extended, especially for replacing the then failing German production. Later the sales of the "Scintilla" got into a state of stagnation, and restrictions in the output became necessary. The attempts to find new markets, particularly in oversea countries, were more or less unsuccessful, especially as prices fell to an unremunerative level. Now the production of "magnetic" apparatus at the "Scintilla" is to be restricted, while on the other hand, the new buildings at Baden are to be shut down, and the manufacture of electrical apparatus of the Brown, Boveri Company is for the most part to be transferred to the works of the "Scintilla." As it is scarcely to be expected that the recent work of the "Scintilla" will yield any return, the Brown, Boveri & Company must write off the whole of its credit in so far as it is not covered by fixed assets, and this will require 7,000,000 fr. The shares in the "Scintilla" were already written off in former years. The report proceeds to state that the situation of the most important participation in Germany (Brown, Boveri & Co., of Mannheim) has rapidly become worse since the beginning of 1923 on account of the occupation of the Ruhr. The losses cannot be specified in figures, and moreover there supervened the catastrophe of the mark. A provisional gold mark balance sheet prepared for the Mannheim Company for 1922 showed approximately a value of 200 marks per share, but an initial gold mark balance sheet for January 1st, 1924, only shows a value of 20 gold marks per share. The directors are constrained, therefore, to write off entirely the whole of the share participation in the Mannheim undertaking. A loan of about 5,000,000 fr. has been granted to the Mannheim works to liberate it from debts and for working capital. Finally the

manufacturing programme and the whole organisation of the Mannheim company have been considerably restricted in order to be able to get over the serious time of the crisis with smaller working funds. The collapse in Germany has also led to difficult conditions in France. Appreciable dangers of losses to the company arose from the depreciation of the French currency. The Swiss company has had to write off 269 million fr. from its participation in the Compagnie Electro-Mécanique, and a sum of 4.70 million fr. has had to be written off the participation in the Alioth Electricity Co. The directors further state that in normal times large reserves had been made which it had been assumed would meet any eventualities, but they had been found to be insufficient. The report then refers to the possibility of the conversion of the undertaking into a purely manufacturing and holding company for reasons of economy in taxation. As to the question of the future, it is mentioned that a considerable improvement has taken place. It is true that sale prices are still unfavourable, but the rapidly growing activity affords good prospects of covering the general expenses and of yielding a return on the capital. The losses for 1923-24 are returned at 25.58 million fr. It is proposed to reconstruct the company by appropriating the reserve fund of 9,000,000 fr. and by writing down the share capital by 30 per cent., or 16,800,000 fr., making a total of 25,800,000 fr., so that a credit balance of 220,000 fr. can be carried forward.

Italian Company.

Società Generale Italiana Edison di Elettricita.—At a recent meeting of this company consideration was given to the matter of increasing the capital from 180,000,000 to 450,000,000 lire, to cope with the enormous increase in the company's business and the necessary extensions. The company has given up contracting loans abroad owing to the high rate of interest exacted, and is relying on the operations of the new Credit Institute for Works of Public Utility. It was proposed that the increase should be made in two instalments —from 180,000,000 to 360,000,000 and from 360,000,000 to 450,000,000 lire. The old shares would receive, first, 6 per cent. from the profits, after which the old and new shares would share the balance.

Altrincham Electric Supply, Ltd.—The report for 1923 recorded a profit of £26,391. After deducting debenture and bank interest, &c., there remained a balance of £20,417, to which was added £4,560 brought forward, making £25,017. The directors' fees and preference share dividends absorbed £3,409, £1,000 was put to the reserve for depreciation, £500 to reserve for doubtful debts, and £14,608 to general reserve. The balance was dealt with as follows:—Dividend of 7½ per cent. on the ordinary shares, and a sum of £1,750 on the deferred shares.

Eastern Telegraph Co., Ltd.—A dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter ending September 30th, 1924, and the second quarterly interim dividend of 2½ per cent. on the ordinary stock, free of tax, payable October 15th, have been declared.

British Insulated & Helsby Cables, Ltd.—The directors have declared an interim dividend of 1s. per share, less tax, on the ordinary shares.

Mississippi River Power Co.—A dividend of $1½ per share has been declared on the preferred stock.

German Company.—The report of the *Hagen Accumulatoren Fabrik Gesellschaft*, of Hagen, for the past financial year shows a profit of 84,661 billion paper marks, which the directors have decided to carry forward. It is stated that the sales only amounted to about half those of the preceding year, but that since a return has been made to gold marks, the business prospects have considerably improved.

Spanish Company.—*La Sociedad Hidro-Electrica Española* reports a net profit of 3,781,377 pesetas for the last financial year, as compared with 2,270,779 pesetas for the preceding twelve months. A dividend of 7 per cent. is being declared.

Oxford Electric Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum, less tax, has been declared on the ordinary shares.

Pritchett & Gold & E.P.S. Co., Ltd.—Interim dividend of 5 per cent., free of tax, on ordinary shares.

Cammell, Laird & Co., Ltd.—An interim dividend of 2½ per cent. has been declared on the 5 per cent. cumulative preference shares, payable October 4th.

British Aluminium Co.—The interim dividend on the ordinary shares is at the rate of 5 per cent. per annum, as in 1923.

Mackay Companies.—A quarterly dividend of $1½ per share has been declared on the common stock.

Globe Telegraph & Trust Co., Ltd.—An interim dividend of 10 per cent., free of tax, upon the ordinary shares is announced.

Bromley (Kent) Electric Light & Power Co., Ltd.—The directors have declared a dividend of 4 per cent., free of tax, on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

IT is not easy to find a word that shall summarise, adequately, the condition of Stock Exchange markets. Some few departments—notably those connected with shares in tea and rubber companies—are very active and firm. Others, and the Home Railway section is a good example of the type, are inert and dullish. Money is coming into the Stock Exchange with an amount of freedom considerably greater than it showed last month. The period of waiting for a trade revival is not yet terminated, and investment has to find profitable employment in the stock markets.

For this reason, Metropolitan Consolidated stock ran sharply from 75¼ to its previous level of 76½ upon a statement that the Exhibition will be re-opened next year. This had been previously affirmed and denied several times, but lack of immediate corroboration failed to stop the twist-up in "Mets." Districts followed suit. The price had been heavy at 50½ prior to the circulation of the Exhibition rumour. People were taking no interest in Home Railway stocks—or so it seemed. The rally in the Undergrounds served to demonstrate that speculative investment is alive to the possibilities of the Underground Railways in the light of another year of Wembley. East London ordinary remains at 5, and the Underground Income bonds, after dipping to 95¼, rallied to 96.

The London tramway stocks and shares continue to mount. London United Tramways 4 per cent. debenture is 3½ higher at 54½, and business was marked last Friday at 56¼. The preference shares, nominally 4s. 3d. middle, are changing hands upon that basis. London and Suburban Traction preference are 1s. up, at 8s., and have been dealt in above that price, while the ordinary found buyers at 1s. 3d. This company's 4½ per cent. first mortgage debenture stock, the interest upon which is duly met, is quoted at 61, and the "A" 5 per cent. debenture, which also receives its full dividend, stands at 86.

Brazil Traction securities are good, too. Brazil Tractions rose 1½ to 55, which is not far short of the price which ruled just before the slump came on news of the Sao Paulo "rebellion." Brazil Tractions fell to 47 then. The Rio exchange is moving in favour of Brazil, and most of the country's securities have been quick to respond. Rio Tramway Fives at 95½ and Sao Paulo Fives at 98 have fully recovered from the slight weakness which shook their values while the "rebellion" was in progress. Para Electric Railways preference found a few bold buyers ready to pay from 3s. to 3s. 3d. for the shares, a few days ago.

Anglo-Argentine Trams are moving up again. The second preference have gained 5s. and the firsts 1/16, this week. Mexican Utilities of various kinds are wanted. The three issues of the Light and Power Company have gained a point each. Mexico Tramways Sixes are 2½ higher. Pachuca 5 per cents., guaranteed by the Mexican Light & Power Company, have risen to 60¼. In the group of Indian industrials, Tata Power 7½ per cent. "B" debenture stock is steady at 92; the 4½ per cent. "A" debenture, which is guaranteed by the Imperial Government, stands at 96. Upon this stock, the first full half-yearly interest payment falls due on November 15th.

Electricity Supply shares are somewhat irregular, though price movements are narrow. St. James's and Pall Mall fell 5s. Metropolitans are 1/16 up. Newcastle ordinary strengthened to 19s. 6d. upon support that came mainly from local investors. London Electrics moved up to 30s. 6d. County ordinary and preference, and Chelseas went ex dividend last week.

Marconis gave way to 32s. 6d. Speculative interest in the shares has once more sunk to a low ebb, and there is but little business doing in any of the wireless shares. Marconi 6½ per cent. convertible debenture stock is a good market at 104½. Marconi Marines have gone back to a guinea. Radio Common at 5¼, and the preferred at 10¼, attract far less attention than a clever little American actor. The group of cable stocks and shares is uninteresting, in spite of the usual quarterly dividend declarations. Chile Telephones have again slipped back a trifle. International Telephones eased off to 25s. 6d.; Automatic Telephones hold their price at 28s. Great Northern Telegraphs put on another 5s. on the assumption that revived trade in Germany would materially benefit the Great Northern company.

British Aluminiums have reacted to 24s. 6d., a fall of 1s. 3d. and Edison 5 per cent. debenture at 71½ is down a point. India Rubber shares are the firmest feature in their own market, a gain of 1s. 9d. raising the price to 16s. 9d., nor have shares been easy to obtain in order to supply the demand which started at the time the price was 13s. 9d. At that figure India Rubbers looked cheap, we were pointing out, in view of the big rises which had rushed up the prices of Callenders, Henleys and "Wires," though India Rubbers were overlooked—at that time.

Rubber shares have developed buoyancy, and the market is seething with a most unusual degree of excitement. The rise in prices makes daily headway, and is based upon the statistical position. Stocks of rubber are coming down, and the price of the produce is rising. Amongst iron, engineering and steel shares, the market tendency is hesitating, the ordinary supporters of such shares announcing definitely that they prefer to wait and see how trade conditions shape before they, the investors, decide to put more money into the industry.

Share List of Electrical Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Sept. 15, 1924.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary	1	12	10	27/-	—	*£5 6 1
Charing Cross Ordinary	1	14	14½	2⅞	—	7 3 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	33/3xd	—	6 12 7
City of London	1	15	15	46/3	—	6 9 10
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 2 2
County of London	1	10	15	46/-xd	—	6 10 4
do. do. 6 % Pref. ...	1	6	6	23/-xd	—	5 4 4
Edmundson's Ordinary	3	7	7	5	— ¼	4 4 10
do. 6 % Pref.	5	6	6	8½	—	5 9 1
Kensington Ordinary	5	12	14	9⅜	—	7 9 4
London Electric	1	10	10	80/6	+6d.	6 11 4
do. do. 6 % Pref. ...	5	6	6	8½	—	5 14 8
Metropolitan	1	8½	10	1⅛	+ 1/16	5 18 6
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	19/6	+9d.	6 3 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1½	—	5 6 8
Urban Ordinary	1	—	4	19/3	—	4 4 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	12⅜	— ¼	7 1 5
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1¼xd	—	5 12 0
Westminster Ordinary	5	12	15	10	—	7 10 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/6	—	7 13 10
HOME RAILS.						
Central London Ord. Assented Stock	4	4		69½xd	—1	5 15 2
Metropolitan ... ... ,,	8½	4		76½	—	5 4 7
do. District ... ... ,,	3	3½		51½	—	6 16 0
Underground Electric Ordinary	10	Nil	Nil	2⅜	—	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—	Nil
do. do. Income Bonds	5	6		96	—	*6 5 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def. ... ... ,,	1½	1½		23½	—	6 6 4
Chile Telephone	5	6	6	5⅜	— 1/16	5 11 7
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16⅛	—	6 4 0
Eastern Tel. Ord.	Stock	10	10	163½	—	6 2 4
Globe Tel. and T. Ord.	10	10	10	17⅜	—	5 15 3
do. do. Pref.	10	6	6	11½	—	5 6 10
Great Northern Tel.	10	24	22	28½	+ ½	7 14 4
Indo-European	25	7	7	89½	—	*5 6 1
Marconi	1	15	10	1⅜	— 1/16	6 1 3
Oriental Telephone Ord.... ...	1	12	12	1⅜	—	*6 3 0
United R. Plate Tel.	5	8	8	6⅜	—	*5 17 0
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16	—	6 4 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	12½	5½	8⅞	+ 1/16	8 0 0
do. do. 2nd Pref. ...	5	5½	6	8½	+ ½	9 4 8
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 0
British Electric Traction Ord. ...	,,	5	6	93½	—	6 8 4
do. do. 6% Pref. ...	,,	6	6	101½	+1	5 18 3
Brazil Traction	100	4	4	55	+1½	7 5 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	9/6	84½	+1	*5 13 6
do. do. Deferred	,,	8	199.5	105½	—	*6 3 3
do. do. Deb.	,,	4½	4½	81½xd	+1½	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	9/-	+1/-	6 5 0
London United Tram. Deb. ...	Stock	4	4	54½	+3½	7 6 10
Mexico Trams. 5% Bonds ...	—	Nil	5	66	—	7 11 6
do 6% Bonds ...	—	Nil	Nil	46½	+2½	Nil
Mexican Light Common ...	100	Nil	Nil	20	+1	Nil
do. Pref.	100	Nil	Nil	47	+1	Nil
do. 1st Bonds ...	—	5	5	63½	+1	8 0 0
MANUFACTURING COMPANIES.						
Babcock & Wilcox...	1	20	12	47/-	—	*5 2 0
British Aluminium Ord.... ...	1	5	5	24/6	—1/3	4 1 8
British Insulated Ord.	1	15	15	55/9	—	5 7 6
Callenders	1	15	15	55/-	—	5 9 1
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	Nil	⅞	—	8 17 10
Edison-Swan	4/-	7½	—	4/9	—	6 0 0
do. ,, 5% Deb.	Stock	5	5	71½	—1	6 19 10
Electric Construction	1	10	10	1⅝	—	6 19 0
English Electric	1	8	5	17/6	—	5 14 3
do. do. Pref.	1	6	6	1	+6d.	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	18/-	—	5 12 0
Henley	1	15	15	55/-	—	5 9 1
do. 4½ Pref.	5	4½	4½	4⅛	—	5 6 0
India-Rubber	1	10	5	16/9	+1/9	*5 19 5
Met.-Vickers Pref....	2	8	8	23	—	6 14 9
Siemens Ord.	1	5	—	1	—	5 0 0
Telegraph Con.	12	20	20	94½	—	*4 17 7

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price Sept. 16.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£125 to £130	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£216	£15 dec.
Grade II ... ... ,, ,,	£156	£8 dec.
Grade III ... ... ,, ,,	£90	...
c Brass (rolled metal 2" to 12" basis) per lb.	9¼d.	...
c ,, Tubes (solid drawn) ... ,,	1/- to 1/0½	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£94	...
c ,, Sheet ... ... ,,	£94	...
c ,, Rod ... ... ,,	£94	...
d ,, (Electrolytic) Bars ... ,,	£68	15s. dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£78	15s. dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f Sheet ... ... ,,	2/- to 3/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/6	1s. inc.
h India-rubber, Para fine ... ... ,,	1/2½	½d. inc.
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£34	10s. dec.
g Mercury ... ... per bot.	£12 5s. to £12 10s.	10s. dec.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 6/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/3½	...
p ,, ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	8d.	...
n Tin, Block (English) ... ... per ton.	£233 15s. to £233	£29 to £29 5s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Generating Sets for a Train.—An order of some interest has recently been carried out by the Parsons Motor Co., Ltd., of Southampton, through Messrs. J. K. Gilliat & Co., Ltd., of London, consisting of two 23-kW electric generating sets for use on the Argentine State Presidential Train. Each unit consists of one of the firm's standard 42-h.p. type engines operating on paraffin fuel and mounted on an extended bed-plate allowing of the direct coupling of the engine and generator. Radiator cooling is provided, the whole unit being entirely self-contained. The engine is of the 6-cylinder type, running at 950 r.p.m., and the generator is so arranged that in addition to charging a number of batteries on the various coaches for lighting the train, it can also be used for the provision of power for driving electric fans, and for other purposes.

Electricity in Agriculture.—Work has been begun by the Wisconsin Committee on the Application of Electricity to Agriculture, of which Dean H. L. Russell, of the College of Agriculture, is chairman. The experimental community selected is situated south-west of Ripon, starting near the city limits and extending out about six miles. About fifteen general farmers and two pea viners will have their farms electrified and studied. Accurate records on the use of all electrical equipment and specially-made farm machinery will be kept and the results will be broadcast throughout the State. It is believed that the community will be visited by many thousands of farmers during the course of the experiments, which will be continued for more than a year. The high-voltage power line which will serve the farm electric laboratory is about completed, and within a very short time the farmhouses and barns will be wired for service.—*Science.*

The Costing of Winding and Insulating Coils.—VI.

By F. C. LAWRENCE, M.C., B.Sc.Tech., A.M.I.E.E., A.C.W.A., Chartered Electrical Engineer.

The Specification and Job Costing.

In the previous notes, reference has been made to job costing, in determining the costs of manufacture of the coils. Now, if that degree of control, which is an essential feature of any sound costing system, is to be obtained, the systems described are not complete in every case, in so far as no comparisons would be forthcoming between the quantities used and the quantities which, according to calculation, should be required. No one who is contemplating the introduction of a costing system can afford to neglect the potentialities of the specification in this respect. It is not enough to know what an operation, a process or a job has cost; it must be clearly demonstrated whether or not the manufacture has been carried through economically.

Specifications are necessary in the shops, for the instruction of those responsible for manufacture, but, whereas the manufacture should be guided by the specification, the only way to secure economy is to check the actual performance with that specified. This lies within the province of the cost accountant. Before the cost of any work is published, it should be checked, in detail, with the specification, and any discrepancies, whether they err upon what may be termed the right or upon the wrong side, should be brought to light, so that either the shop practice or the specification quantities may be set right. The value of the cost accountant's work is largely measured by the wastages of material, time and expense which he discovers and which, through his reports and suggestions, are eliminated. This constitutes the most obvious, but, perhaps, not the most effective way in which a costing system is able to pay for itself.

The Costs of Tests and Inspection.

More and more are engineers realising that the use of the terms "Productive" and "Non-productive" labour is apt to make invidious distinctions in their factories, owing to the fact that many items of labour cost which are charged to overhead expenses, thereby falling under the category of non-productive labour cost, are representative of labour which is as essential to manufacturing as is the work of a skilled fitter or turner. It is certainly true that the testing and inspection of apparatus is far from non-productive, for to omit the testing or the inspection of a coil, particularly if it is designed to withstand a high voltage between turns, would be seriously to damage its chance of making a success of its intended function in, say, the transformer, for which it is destined. It is just as important that it should be subjected to a careful inspection, as it is that it should be wound to the correct shape.

When such facts are realised, the engineer turns to the less reproachful term "Indirect" labour, with its natural counterpart in the term "Direct" labour; but, even the term "indirect" does not do justice to many items of labour usually included in overhead expenses. The sweeping up of the shop does not bear more than a slender relation to the actual manufacture of a machine, and it may well be classed as indirect, but the inspection and the testing of apparatus and machines is very closely allied to the actual manufacture, so that it may really become direct labour. Admittedly, the easiest way of dealing with its cost is to dump it in with the overhead, but the maxim of the true cost accountant should be to charge directly every item of expense possible, within practical limits, and to include in the overhead only those items which, in practice, do not admit of direct charging. Why, then, should not the cost of testing and inspecting coils be a direct charge to jobs and orders? It should be, undoubtedly, and not before it is so charged will the individual cost of the coils bear their true share of the cost of these two services.

The Treatment of Overhead Expenses.

The work of a department of a factory manufacturing coils has been shown to divide itself into a number of sections, the functions of which are, to a great extent, separate one from another. It has been seen that each section has to be treated individually, as far as its prime costs are concerned, and it follows that the overhead expenses must be considered from the standpoint of the section, rather than that of the department. In reviewing what has already been said, it is noticeable that many items of expense, apart from the standing charges, such as insurance, rent and depreciation, and the general shop charges, such as maintenance, transport, storekeeping and sundry office expenses, have not been included in the prime cost. Among the most prominent of these are the costs of heating appliances, such as the heating elements in the Haefely machines, varnish-paper cylinder machines, and the heating arrangements used in connection with stove enamelling and impregnation; the extra ventilation rendered necessary by the dust created in the sawing and shaping of washers, blocks, &c.; the supply of small tools and the foremen's salaries. All such items are peculiar to the section in which their service is employed, and their cost should be charged as overhead expenses in their respective sections.

It might be possible, of course, to charge out the cost of power to orders, on such operations as Haefely wrapping, if a meter were to be placed in the supply circuit of the heating elements, or, again, the foreman of any one section might be able to book at least a part of his time to particular jobs or processes, in either of which cases the expense would become a part of the prime costs and would be directly included in the costs of the jobs or processes concerned.

It has been shown that it is possible to deal with the cost of testing and inspection by other means than its inclusion in overhead and, if the necessary meters can be installed or the foremen made to book portions of their time, it might be advisable to divert the cost of power and foremen from overhead expenses to prime costs. It is here that theory and practice are somewhat in conflict, and the question of inclusion or of exclusion, in any one case, must be decided on the grounds of expediency. The wholesale employment of meters, the booking of readings, and the consequent calculation of charges may or may not interfere with production or lead to excessive clerical labour. If they do, the only alternative lies in charging the cost of the service to overhead and not to prime costs, but it should never be assumed that, because an item of expense does not lie within the ambit of what is commonly understood to be direct labour or material, it must immediately be thrown into the overhead. It should be attempted, in the first instance, to find out whether it is economically possible to make a direct charge of the expense to jobs or processes, and only if this test fails is it justifiable to turn to that ever receptive, but often over-burdened, convenience, "overhead expense." Every known method of distributing overhead to jobs and processes is a compromise and can never result in anything better than a fair approximation; once an expense becomes an overhead expense, instead of a direct charge, its identity is lost and, therefore, its control, excepting so far as the general supervision of overhead is concerned, also disappears.

If the cost of power is treated as an overhead expense and averaged out to jobs and processes according to the

time taken or the wages paid, it is unlikely that the assessment made will coincide with the true usage of power in any one case. Thus is the "law of averages" mutilated in its everyday application.

Having then, for the whole of the coil department, arrived at a point where everything possible has been charged directly, the remainder will represent the total overhead expense, which is not difficult of equitable distribution between the sections of the department.

It is not proposed to describe in detail how expense rates are calculated, for that subject has been dealt with at length in the many books on costing, which are easily obtained and which give full accounts of the bases of distribution of each item of expense and of the various calculations involved.

There are two principal methods of expense distribution in engineering factories, the percentage to direct wages cost and the hourly rate methods, and the weight of evidence is sufficiently in favour of the latter to warrant its choice as the more accurate means of allocation to jobs and processes in the majority of cases.

Before the rates can be fixed, the sections need to be divided into groups, each consisting of a number of similar machine or hand operations, and the total expense of each section sub-divided between the groups. This is, perhaps, more difficult than dividing the departmental overhead between sections, but, by a careful determination of the power used by each group, of the floor space occupied, and of the proportion of each service absorbed, and with a knowledge of the number of workers in each group, all the expense can be reasonably apportioned by a practical cost accountant.

Difficulties arise, however, where steam heating is employed; in the enamelling and impregnating shop, for instance, it will be no easy matter to charge, separately to the various processes, the cost of steam, for such measurements of steam consumption constitute a problem which the engineer has not altogether succeeded in solving. Nevertheless, a very fair approximation can usually be agreed upon, in consultation with the power-house engineer.

Defective work presents another problem to the cost accountant who is responsible for calculating expense rates. Expense rates are set up upon a basis of the working of past periods, and are then used until the necessity for revision arises, owing to altered conditions. In setting out to include a fair allowance for defective work, the period considered may contain abnormal charges under this heading, and it is necessary to review those charges in the light of current conditions. Some defect in a wrapping machine may have caused many jobs to be spoilt, but when this defect has been remedied, the work can be expected to go through with considerably less spoilage, that is, the cost of defective work on these machines will be reduced; the allowance must consequently be based, not upon past results, but upon the future probabilities. Every item should be reviewed with this object in mind, before the rates are put into force. Predetermination of the rates should, therefore, provide for the complete absorption of the actual expenses of the ensuing period. It is not enough for the cost accountant to gather together all the items of expense; he must examine each one and, if necessary, modify it in the light of current shop practice.

Once the expense rates have been calculated, it is easy to charge each order or process with the correct amount of overhead expense. Provided that the job tickets for labour show the number of hours worked in each group upon each job or process, the group-hours can be ascertained when the costing is being carried out and the hours in each group, multiplied by the rates, will give the overhead for each group, the sum of the group totals being the total overhead charge for the job or process.

It will be obvious to anyone acquainted with a coil department that the winding heads for transformer coils occupy far more space per worker than do the benches used by the mica varnish product builders, and that more power is absorbed in the Haefely machine section than in the copper section, so that the necessity for using different rates for each section, including only their fair shares of the services mentioned, will be immediately apparent. The rates, when calculated, whether they be hourly rates or percentages, for that matter, will be so divergent that no thought will be entertained of reverting to the less accurate methods previously in force.

Production Planning.

Many of the suggestions made may lead to results which will be useful for purposes other than the costing of the products and the financial control of manufacture. In the case of the mica varnish products, for example, the desirability of establishing a sub-store was pointed out and, for the system of process costing applied to the stove enamelling, full statistics are forthcoming of the quantities enamelled and the number of times certain pieces are treated. These are essential to the costing systems described, but their use is by no means restricted to the costing function. The data which emanates each period from the shop returns, based upon the systems described, will prove exceedingly valuable to the production planner. In such a department the work cannot very well be planned successfully unless a considerable amount of statistics is available, which will demonstrate clearly the quantities of materials used, the time taken for each operation and process, the stocks which need to be maintained for normal production, and the machines or appliances most suitable, with their output capacities. In the extraction of such necessary information, the cost accountant and the production engineer must be in co-operation. The former, in the performance of his duties, can collect the figures from the returns made to him, and the latter may depend upon accurate figures being given by the cost accountant, presented in such a way that they are eminently adapted to his requirements.

Electric Power in Australia.—Lieut.-General Sir John Monash, in his presidential address at Adelaide to the Australasian Association for the Advancement of Science, discussing power development, is reported by the *Daily Telegraph* to have said that Australia's consumption of electrical energy was six hundred million kWh annually, or less than 1 per cent. of the world's total. Anticipating rapid progress, the prospective consumption of the present population of the Commonwealth would be six thousand million kWh anually, and it would be necessary to provide generating plant with a capacity of 1,250,000 kW. Taking the example of Victoria, treble the present capacity would be necessary, and far-reaching plans for meeting the situation were required. Sir John referred to misapprehensions about water power. The total available in the world did not exceed five hundred million horse-power, of which Australia's share, excluding Tasmania, was one million. It was clear that Australia must look principally to her fuel resources to meet the demands for energy. There was a wide disparity in the volume and the flow of the streams in the rainy and the dry seasons. Hydro-electric schemes must be capable of producing a constant output. The limitations were severe, as in continental Australia the conditions had no analogy for the great lakes scheme of Tasmania and the hydraulic resources of New Zealand. Therefore, the advocacy of hydro-electric schemes for Victoria, in preference to power stations based on the brown coal deposits, was doomed to failure. His forecast of the future requirements of Australia was based on the experience of the United States, and would involve, with a population of fifty millions, the production of energy equivalent to three million tons of black coal annually. The Victorian State electricity scheme, which Sir John Monash controls, utilises the power house at Yallourn, and the group of hydro-electric stations in the Goulburn Valley as basic stations, with a power house at Newport as a peak station. In various parts of Australia and New Zealand a beginning has been made in emulating the American and Canadian examples of connecting rural areas with centralised generating plant of major capacity. The importance of Sir John's address from the British standpoint lies in the indication of the great demand in the near future from all parts of Australia for electrical plant in connection with an extensive distribution scheme. Doubtless British firms will keep themselves in close touch with these developments.

Australian Water Scheme.—The New South Wales Public Works Committee has approved a water supply scheme for the south-western portion of the State, estimated to cost more than £1,500,000. The water will be lifted from the Murrumbidgee River at Jugiong to Saddle Hills, above Cootamundra, whence it will be distributed by gravitation. Electric power generated at the Burrinjuck dam will be utilised.—*Daily Mail.*

The Machine Tool and Engineering Exhibition.

THIS exhibition, as mentioned in our last issue, was opened at Olympia, on September 5th; it remains open until September 27th. Although but a small part of the display represents electrical engineering, with control apparatus as the principal subject, there has been a marked advance in the method of employing the electric drive. It is becoming more and more the standard practice to make provision for the electric motor as an integral part of a machine tool, and many good examples of this construction are on view at the present exhibition. We deal below with the principal exhibits of an electrical nature.

Igranic Electric Co., Ltd.

This company has arranged a number of examples of its apparatus in a small space. There is the "U-Re-Lite" circuit breaker for use in workshops in the place of a main fuse. It is made in a wide range of sizes for d.c. and single-phase circuits. Two separate poles with distinct closing motions are provided so that the breaker cannot be held in against an overload or short circuit. The breaker is released by the pressing of a knob. A totally-enclosed starting rheostat is shown, fitted with no-volt and overload releases. Among the control equipment is the magnetic lock-out type starter illustrated in fig. 1. By the use of this, if the starting load be light the starting resistance is cut out quickly, and *vice-versa*. For the control of variable-speed d.c. motors, the company shows a "Varispede" panel of which the principal feature is the accessibility of its parts. This panel embodies a shunt-regulating device which makes it particularly suitable for the control of radial drills, shaping and slotting machines, &c. There is an automatic universal panel for small variable-speed motors, suitable for use with lathes, boring, and milling machines, and a reversing drum controller applicable to cranes and travelling gantries. In the d.c. design dynamic braking is arranged for. The starters exhibited include an automatic a.c. motor starter with push-button operation, a hand-operated polyphase starter, an auto-transformer starter, and an a.c. starter for a motor having a rotor current of 100 A. Other exhibits are push-buttons, contactor switches, &c.

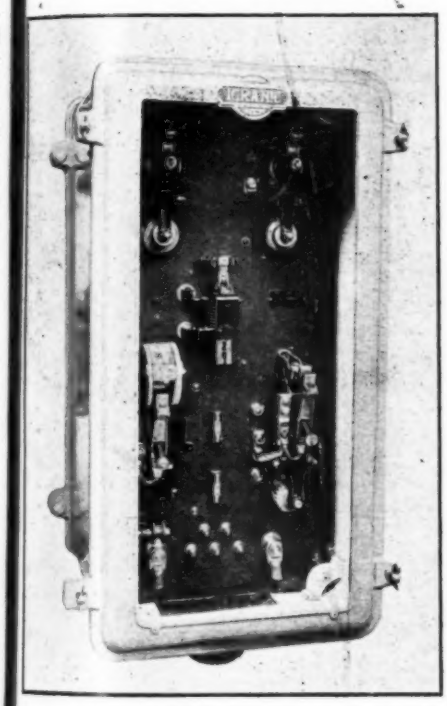


Fig. 1.—A Magnetic Lock-out Type Starter.

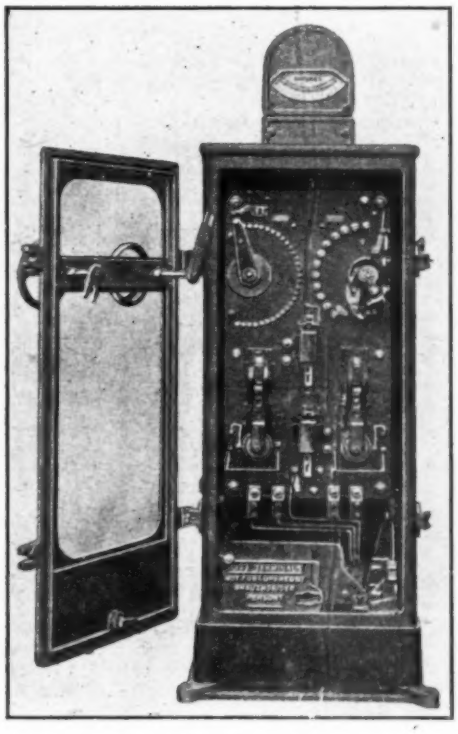


Fig. 2.—A "Vauxhall" Hand-operated d.c. Control Pillar.

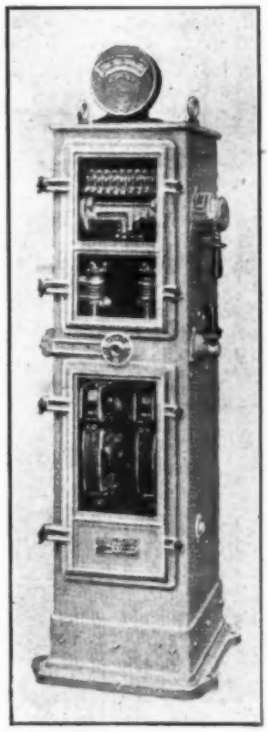


Fig. 3.—A "Brookhirst" Drum-type Control Panel.

The Electrical Apparatus Co., Ltd.

Several typical "Vauxhall" control pillars are shown by this company, comprising a.c. and d.c. patterns for hand or automatic control. A view of the hand-operated d.c. type is given in fig. 2. The apparatus has a cast-iron base and crown surmounted by a sheet-steel casing, which is easily removed, leaving the panel open for inspection or repair. The drum-type isolating switch which is fitted is operated by a handle on the front of the case, which also locks the gear in. The switch contacts are covered by a hinged flap. The starter is provided with copper roller contacts, which are easily renewable, and has neither hold-on coil nor hub spring. The starting resistance can be a non-corrodible strip grid, cast grids, or enamelled steel tubes wound with non-corrodible wire. The field regulator is interlocked to ensure that it is in the full field position before the rotor can be started. The contactors are of heavy construction, and fitted with magnetic blowouts. The operating coils form a no-volt release, and the overload releases, one in each pole, break the contactor coil circuit. The resistances can be inspected through an opening at the back. "Vauxhall Junior" panels are of a smaller type, suitable for mounting on a wall or directly on the machines which they control. Examples of heavy-duty roller contact starters are shown. These embody automatically-operated contactors which make and break the circuit and eliminate all arcing on the main starter contacts. Contactors of from 60 to 1,000 A capacity form another exhibit, and there are also shown drum controllers of the air-break and oil-immersed types. Other exhibits are universal sealing boxes for use with armoured cables, so arranged that whatever the direction from which the cable approaches the gear the box can be adjusted to suit; complete control units for a.c. motors; moving iron ammeters; and house service meters.

Brookhirst Switchgear, Ltd.

This firm also shows control gear, but its main "exhibits" are distributed throughout the exhibition, *i.e.*, there are over 50 examples of its work on the stands of other exhibitors. These show the gear in the best possible way—in actual operation. On the stand of Messrs. H. W. Ward & Co., Ltd., are three turret lathes and a broaching machine controlled by "Brookhirst" drum-type panels. In these the main circuit is opened and closed by two electrically-operated magnetic blowout contactors. To close these the ratchet operating handle (see fig. 3) must, before starting up, be raised to an upright position. Ratcheting may then be commenced, but if the handle is released before reaching "full on," its fall will open the contactors, and the operation has to be recommenced. "Midget" type panels are applied to a lathe on the same stand. These have faceplate starters, and motor protection is provided by a no-volt release, an overload trip, and two fuses. An open-side planing machine on the stand of Messrs. Ward, Haggas & Smith is equipped with a "Brookhirst" solenoid type panel and push-button control. This incorporates an instantaneous full-face butt contact on each step and not a sliding contact involving sparking. The starter movement is governed by an eddy-current retarder in the place of the usual dashpot arrangement. This being in

series with the motor armature, the retarding effect is in proportion to the load. There are several other important examples of the use of the firm's apparatus.

Messrs. Alfred Herbert, Ltd.

Messrs. Herbert have a comprehensive display of their milling machines, turret and capstan lathes, and other large machine tools. Included among these are three electric welding machines of the seam, butt, and spot patterns. The longitudinal seam welder, illustrated in fig. 4, is capable of welding two thicknesses of clean steel sheets of from 26 to

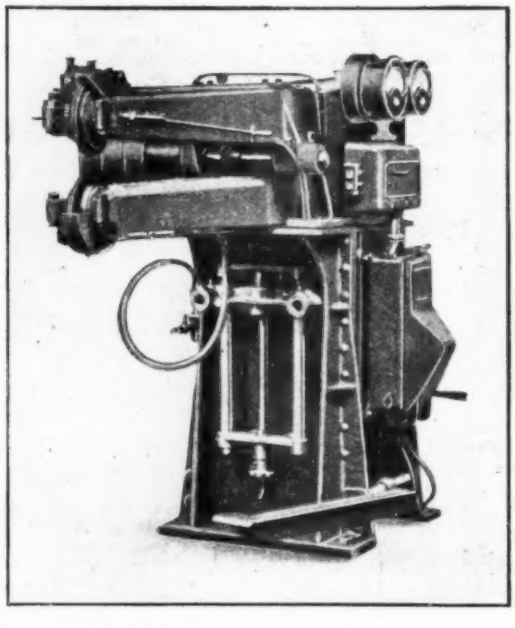


Fig. 4.—A "Herbert" Seam Welding Machine.

14 s.w.g. The roller electrodes are mounted in suitable bearings and efficiently water-cooled. The transformers embodied in the machine are oil-immersed, and specially insulated and impregnated for use in hot and humid climates. The machine shown is rated at 20 kW, and has a net weight of 1,449 lb. The butt welding machine exhibited is rated at 30 kW, and is designed to deal with mild steel of 1.5 sq. in section. The standard clamps supplied are screw-gripping combined with a quick releasing device, and they are water-cooled. The pressure is applied by means of a hand lever or hand-wheel control, the latter being designed for tool tipping and the butt welding of tubes. The rating of the spot welding machine is 20 kW. The operation of a foot pedal to bring the electrodes together on the work also switches on the current, and continued pressure switches off the current, allowing the weld to cool while still under pressure. The operating voltage ranges from 1 to 4, the transformers being embodied in the machine as in the previous instances. A plug box giving a variable range of heating temperatures is provided to enable adjustment to suit the thickness of material being welded to be made. The example shown can deal with mild steel $\frac{3}{8}$ in. thick.

Messrs. Reavell & Co., Ltd.

Blowing and compressing plant is shown by this company. These sets are both engine- and electrically-driven, and are designed for varying outputs up to 600 cu. ft. per minute at pressures up to 250 lb. per sq. in. The display includes the "Sub-Station" compressor, described in a recent issue of the ELECTRICAL REVIEW, which is primarily intended for the blowing out of electrical machinery and for similar purposes. This has a delivery of over 8 cu. ft. of air per minute at a pressure of about 20 lb. per sq. in. It is provided with handles for lifting, and is mounted on a small three-wheel trolley for mobility.

Messrs. Mossay & Co., Ltd.

The transporting and lifting machinery shown by this company includes the "Ransome" runabout crane made by Messrs. Ransome, Sims & Jefferies, Ltd. This has previously been described by us (ELECTRICAL REVIEW, February 16th, 1923), and it is sufficient to briefly run over its salient features. It is made in three sizes, to deal with 7½, 15 or 20 cwt. A 129-Ah or 258-Ah lead accumulator battery is fitted, and this provides energy to two 1.25-h.p. motors which propel the crane, and to a 3-h.p. motor which operates the hoisting drum. Its principal advantages are the low head room which it requires, its mobility, and its ability to turn in its own diameter. The company also shows an electric lifting truck, and two examples (5 and 50 h.p.) of open-protected shunt wound d.c. motors.

Other Exhibitors.

Other firms showing apparatus of electrical interest are the Coventry Chain Co., Ltd., which exhibits a chain reduction box driven by an electric motor; the Britannia Lathe and Oil Engine Co. Ltd., electrically-driven lathe; Messrs. Edward G. Herbert, Ltd., static and dynamic balancing machine, a "pendulum" hardness tester, &c.; Messrs. Frederick Mountford (Birmingham), Ltd., an electrical grinding attachment for a lathe; Messrs. Burton & Griffiths, Ltd., a direct motor-driven bench drill; the Hoffman Manufacturing Co., Ltd., ball and roller bearings, reduction gears, and a "Broadbent" centrifugal hydro-extractor; and the Selson Engineering Co., Ltd., electrical drilling and grinding machines, and a 1-ton electric pulley block.

The Generation of Electricity in Great Britain.

Fuel Consumption and kWh Generated during 1923-24.

THE Electricity Commissioners' summary of the generating statistics submitted to them, under the Electricity (Supply) Acts, 1882-1922, in respect of the year ended March 31st last, is now available.*

Returns were received from 541 undertakings, and of these 450 have been given places in order of merit (*i.e.*, based on thermal efficiency) in comparison with stations of the same group and class in their respective areas, and also on a national basis. The remaining 91 stations were not so classifiable, either because they were not in operation for the greater part of the year, the entire output was generated by waste heat, water power, &c., or the major portion of the output was generated by these means. Where the calorific value of the fuel used was not specified, the Commissioners based the efficiency upon the average calorific value of the same class of fuel used at all other stations in the same area. The Commissioners again impress upon undertakers the importance of ascertaining the calorific value of the fuel consumed at their stations.

As compared with the previous year, the total output showed an increase of nearly 943,000,000 kWh, or 16.4 per cent., whereas the total consumption of fuel showed an increase of 772,157 tons, or only 11.3 per cent. Thus the average consumption of fuel at steam stations was reduced from 2.78 to 2.67 lb. per kWh generated—a saving of about 4 per cent. At oil stations the reduction was from 1.72 to 1.49 lb. per kWh—a saving of 13 per cent. The average fuel consumption at gas producer stations also showed a decrease from 2.70 to 2.63 lb. per kWh, or 2.6 per cent.

The first table deals with steam stations grouped according to their total output. There were three stations which supplied more than 200 million kWh, as in 1922-23, and these showed a reduction in the fuel consumed per kWh from 2 to 1.96 lb., for a total output of 715,219,124 kWh. As in 1922-23, the Carville "B" station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., had the lowest consumption in this class (181 lb.), but Glasgow Corporation's Dalmarnock station stood first in point of thermal efficiency (17.47 per cent.).* Two stations have been added to the second group, which contains stations which generated between 100 and 200 million kWh, there being eight in 1923-24. These produced 1,205,834,928 kWh with the expenditure of 1,149,111 tons of fuel—an average of 2.13 lb. per kWh. The Newcastle company again headed the list, its North Tees station having a consumption of 1.67 lb. per kWh and a thermal efficiency of 17.60 per cent. The third group (with individual outputs between 50 and 100 million kWh), comprised 28 stations with a total production of 1,782,547,188 kWh and a coal consumption of 2,068,523, giving an average of 2.59 lb. per kWh. This group includes the Barton station of Manchester Corporation,† which made the best showing of any station in Great Britain with a thermal efficiency of 20.33 per cent. and a fuel consumption of 1.48 lb. per kWh. This group had the largest aggregate output of all the groups. The fourth section deals with stations which generated between 25 and 50 million kWh, and shows a total production of 1,071,254,294 kWh and a fuel consumption of 1,253,124 tons—2.62 lb. per kWh. There are 32 stations in the group, and the Hackney Corporation had the lowest fuel consumption, 2.07 lb. per kWh, while the best thermal efficiency was that of the Ayrshire Electricity Board's Kilmar-

*Stationery Office. Price 1s. 6d. net.

*Accidentally attributed to Carville "B" in our last issue.
† Commenced supplying October 11th, 1923.

nock station, 15.73 per cent. The fifth group, covering stations with outputs between 10 and 25 million kWh, consists of 60 stations which generated 938,120,595 kWh with an expenditure of 1,219,400 tons of fuel—2.91 lb. per kWh. The best results were obtained by Accrington Corporation, with a fuel consumption of 2.03 lb., and Wallasey Corporation, with a thermal efficiency of 14.38 per cent. These five groups (131 stations) were responsible for the bulk of the energy generated by steam stations; they produced 5,712,976,129 kWh out of a total of 6,342,107,841 kWh. It will be sufficient to give the briefest details of the other groups, which are denoted by the letters F to M in order of size, and include 220 stations.* The particulars given are group fuel average, best average, and best thermal efficiency.

Group F.—3.84 lb.; †Brompton & Kensington Electricity Supply Co., Ltd. (2.08 lb); Southport Corporation (11.78 per cent.).

Group G.—4.09 lb.; ‡Finchley Urban District Council (2.44 lb.); ‡Finchley Urban District Council (12.74 per cent.).

Group H.—5.48 lb.; ‡Wycombe (Borough) Electric Light and Power Co. (3.03 lb.); ‡Wycombe Electric Light and Power Co. (10.97 per cent.).

Group I.—7.93 lb.; Horsham Urban District Council (4.14 lb.); Paignton Electric Light & Power Co., Ltd. (6.92 per cent.).

Group J.—7.46 lb.; ‡Isle of Wight Electric Light & Power Co., Ltd. (Sandown) (4.18 lb.); ‡Isle of Wight Electric Light & Power Co. (6.45 per cent.).

Group K.—12.80 lb.; Rothesay Tramways Co., Ltd. (5.04 lb.); Dawlish Electric Light & Power Co., Ltd. (5.61 per cent.).

Group L.—16.10 lb.; Southern Railway, Queenborough Pier (11.00 lb.); L.M.S. Railway, Sandon Dock, Liverpool (2.96 per cent.).

Group M.—36.30 lb.; L. & N.E. Railway, Silloth (3.51 lb.); L. & N.E. Railway, Silloth (7.65 per cent.).

The foregoing stations produced a total of 6,342,107,841 kWh, and consumed 7,561,991 tons, giving an average consumption of 2.67 lb. per kWh, as compared with 2.78 lb. in the preceding year. The figures show in a striking manner how the fuel consumption rises as the stations are reduced in size; they also indicate, however, that the highest thermal efficiency is not always obtained in the largest station. It is to be noted that, in addition to the foregoing there were 40 unclassified steam stations.

There were no gas producer stations with an output greater than 2,500,000 kWh. In the next class (H), over 1,000,000 kWh, there was only one "placed" station, that of the ‡Leek Urban District Council, which produced 1,622,034 kWh, and consumed 1,363 tons of fuel, an average of 1.88 lb. per kWh; the thermal efficiency of this station was 13.64 per cent. As in the case of the steam stations, we give brief details of the ensuing groups:—

Group I.—2.82 lb.; ‡Bridgwater & District Electric Supply and Traction Co., Ltd. (1.85 lb.); ‡Bridgwater Electric Supply & Traction Co., Ltd. (12.00 per cent.).

Group J.—2.63 lb.; ‡Trowbridge Electric Supply Co., Ltd. (1.67 lb.); ‡Trowbridge Electric Supply Co., Ltd. (12.73 per cent.).

Group K.—2.46 lb.; ‡Tewkesbury Electric Light Co., Ltd. (1.60 lb.); Chippenham Electric Supply Co., Ltd. (13.00 per cent.).

Group L.—3.42 lb.; ‡Ledbury Electric Supply Co., Ltd. (1.47 lb.); ‡Ledbury Electric Supply Co., Ltd. (14.08 per cent.).

Group M.—3.21 lb.; Electric Supply Corporation, Ltd., Dollar (3.02 lb.); Electric Supply Corporation, Ltd. (8.18 per cent.).

In this section 52 stations which produced 13,759,285 kWh, used 16,161 tons of fuel—an average consumption of 2.63 lb. per kWh, as compared with 2.70 lb. in 1922-23. These figures again show a small consumption in the larger stations, but, again, the highest efficiency is not found in the largest station.

Oil engine stations are unrepresented in the first seven groups. Altogether the 47 stations which are classified generated 33,386,317 kWh with 22,293 tons of fuel, an average of 1.49 lb. per kWh, as against 1.72 lb. in the previous year. There were 10 stations which produced more than 1,000,000 kWh. These had an average fuel consumption of 1.76 lb., and the Electricity Co. of Macclesfield, Ltd., again headed this class, although its results were not so good, with a consumption of .68 lb. per kWh and a thermal efficiency of 26.80 per cent. The figures for the remaining five groups were as follows:—

Group I.—1.43 lb.; East Anglian Electricity, Ltd., Felixstowe (0.63 lb.); East Anglian Electricity, Ltd. (29.10 per cent.)

Group J.—0.91 lb.; Bognor Gas, Light & Coke Co. (0.64 lb.); *Hebden Bridge Urban District Council (27.60 per cent.).

Group K.—1.75 lb.; Frinton-on-Sea & District Electric Light and Power Co., Ltd. (0.76 lb.); Frinton Electric Light and Power Co., Ltd. (24.21 per cent.).

Group L.—0.99 lb.; *Windsor Electrical Installation Co., Ltd. (0.78 lb.); *Windsor Electrical Installation Co., Ltd. (24.15 per cent.).

Group M.—1.35 lb.; Warminster Electric Supply Co., Ltd. (1.36 lb.); Warminster Electric Supply Co., Ltd. (13.20 per cent.).

Table 6 of the report contains in classified form the following information:—There were 19 stations using waste heat (8 "composite"), and together these generated 218,274,879 kWh. Refuse destructor stations numbering 27 (23 composite) produced 26,125,596 kWh. Gas engine stations using town's gas, 11 in all (3 composite), generated 3,775,558 kWh; and there were 28 water-power stations (18 composite) which accounted for 44,094,796 kWh. These "miscellaneous" stations, numbering 85 (52 composite), thus produced a grand total of 292,270,829 kWh, as compared with 239,343,822 kWh in 1922-23.

Table 7 is the most comprehensive; it shows in a concise manner the best results at stations of each size and class in all areas. From this it is seen that the lowest fuel consumption per kWh generated at any station included in the returns was 0.63 lb., which, as recorded above, was the figure for the Felixstowe oil engine station of the East Anglian Electricity, Ltd. The best result for a steam station was 1.48 lb. per kWh. This, of course, was obtained in the Barton station of the Manchester Corporation. The lowest gas station fuel consumption was at the composite station of Ledbury Electric Supply Co., Ltd. The highest thermal efficiency among all the stations was again at an oil-engine station—29.10 per cent. at Felixstowe. Barton naturally headed the steam stations in this respect.

Table 8 gives particulars of the energy generated and the fuel consumed in each of the 26 areas. From this it is seen that more than a quarter of the total (1,768,070,741 kWh) was generated in the London and Home Counties Electricity District. In No. 16 area (Durham, Northumberland, and parts of Yorkshire) the total production was 985,911,020 kWh; this was followed by No. 3 area (South-East Lancashire) with a production of 741,676,570 kWh. Together these three areas accounted for over half of the total. This table also shows that the total energy generated was allocated as follows:—Steam, 95.08 per cent.; gas producer, 0.26 per cent.; oil engine, 0.49 per cent.; waste heat, 3.21 per cent.; refuse destructor, 0.36 per cent.; town's gas, 0.05 per cent.; and water power, 0.55 per cent.

*With annual outputs ranging from 5-10 million kWh, down to less than 50,000 kWh.
† Wholly oil fired.
‡ Composite stations.

Electricity Supply Workers' Wages.

On Wednesday last week the special Committee appointed to inquire into the dispute concerning wages in the electricity industry held its first public sitting at the Ministry of Labour, Whitehall. The tribunal consists of two members representing the employers and two representing the employés, all drawn from the National Joint Industrial Council for the Electricity Supply Industry, with an independent chairman, appointed by the Minister of Labour. The members are Mr. W. Addington Willis (chairman), Alderman J. P. Dean, Mr. John Turner, Mr. W. B. Woodhouse, and Mr. S. E. Fedden.

The chairman, in opening the proceedings, explained that the terms of reference were:—

"To examine and report upon all the facts material to the issues between the employers and the workers arising out of the present application for an all-round increase of wages of 10s. per week and to make recommendations to the National Council thereon, and to report and make recommendations to the National Council within a reasonable time."

Mr. A. TAYLOR, representing the National Union of Corporation Workers, which has a thousand members employed in the industry, asked the ruling of the chairman as to the safeguarding of the position of his members. His Union had applied for membership of the Joint Industrial Council, but the trade union side of the Council had objected. The union was a member of the Scottish Regional Council.

The CHAIRMAN said that the tribunal felt that the issues raised did not come within the terms of reference.

Mr. J. ROWAN, general secretary of the Electrical Trade Union, then submitted the case for the workers. In his statement of claim, he said that the employés' side of the National Joint Industrial Council for the Electricity Supply Industry put forward in February last a claim for an all-round increase of 10s. per week for the workmen which they represented. The number of these workmen, according to the employers' figures, was 29,000, and the total wages advance per annum involved in this scheme would be, roughly, £754,000. The grounds of the claim were:—(1) That the industry could well afford to pay the advance. (2) On account of the severe reductions, accentuated in some of the areas, which it was considered were not justified. (3) The respon-

*Partial bulk supply taken.

sibility and inconvenience attached to the industry warranted an advance, especially in view of the concentration developing in the generation of electricity by which the output per man was largely increased and the general labour costs per kWh greatly decreased.

Mr. Rowan said that the National Joint Industrial Council was established in the year 1919, and a little later 13 District Joint Industrial Councils were set up. Each of these districts established agreed sets of conditions of work, wages and hours of labour which were based mainly on the London 2,772 award arranged in 1917. There were slight alterations to suit the differing conditions in the areas, but, generally, it could be said that a percentage reduction was made on the London rates. No general advance took place on these rates. Two reductions, however, took place by agreement, one of 3s. 4½d. in July, 1921, and one of 3s. 4½d. in September, 1921. The adoption in November, 1921, of a national sliding scale agreement had led to further decreases. Since the agreement was adopted there had been net reductions of 16s. per week, making, with the 6s. 9d. previously enforced, a total reduction of 22s. 9d. per week.

Besides these reductions, in November, 1922, the employers' side of the Council asked for further reductions of wages supplementary to the National Agreement. The Council was unable to agree upon this, and eventually the matter was referred to the various District Councils for local settlement. This resulted in a series of settlements varying from 12½ per cent. reduction in local wages down to no change at all. This brought about a further variation in the already varied rates paid in different parts of the country, and the greatest reductions took place in just those areas that had been hardest hit by the industrial depression.

In February, 1924, owing to requests having been received by the workers' side of the National Council from various areas for an advance of wages, a conference was called, and it was decided to make application for a 10s. per week flat rate advance for all areas. The employers refused to discuss this advance, but offered to refer the application to arbitration, but this offer was refused by the workers' side. As a result of a ballot it was decided to give 14 days notice to strike, the notice commencing on August 15th. With a genuine desire, however, to prevent by all reasonable means a strike in this important industry, a proposal to meet the employers' side together with a conciliator appointed by the Minister of Labour, was accepted, and the strike notices were suspended.

Referring to the ability of the industry to pay the increase, Mr. Rowan said that it was not merely sheltered from foreign competition, but it was sheltered from internal competition, and was a complete monopoly industry. The men considered that the advance could be met without imposing any additional charge on the consumers.

Mr. Rowan, basing his statement on the figures of some 300 concerns, said that the cost of production per kWh sold was 1.23d., and the increased cost involved by the additional wages would be only .057d. per kWh. These calculations, he said, seemed to represent an unimpeachable case for the application put forward. In dealing with the 300 cases, the losses shown by nine undertakings had been deducted. The local authorities had, generally speaking, been in the habit of allocating to the relief of rates a proportion of their profits. There was a strong objection to using profits from an electricity undertaking for the relief of rates instead of improving the service—including the condition of its employés. Since the year 1912/3 the ratio of profit to working expenses had increased. In these figures there had been no general comparison of the total return to capital compared with the total return to labour in the industry, yet it was well known that since the beginning of the industry there had been a steady rise in the proportion of capital held as debenture stock, and it was equally well known that in recent years there had been a very considerable increase in the rate of interest paid on debentures. This interest, though it was not normally included in the gross profits of an undertaking, was, nevertheless, part of the return to capital to be balanced against the return to labour.

Alderman WALKER, who appeared for the employers, cross-examined Mr. Rowan, and suggested that the wages in the electricity supply industry were higher than those in other industries; Mr. Rowan would not admit this, nor would he agree that electricity had to meet strong competition from other forms of power. Alderman Walker pointed out that the men received holiday pay, and also that any increase in wages must result in an increase in the price of electricity to the detriment of workers in other industries. He challenged the figures of profits put in, and said that in many cases there was no profits at all as there had not been deducted the amounts to be paid to reserve and suspense accounts. Workers in the municipal gas and water departments doing such work as mains laying were not getting such high rates as the electricity undertaking labourers, and yet it was asked that a further 10s. per week should be given to the latter.

Mr. ROWAN said he had heard that an application for higher wages was to be made by the other Corporation workers, although he was not aware of it himself.

It being suggested that it was becoming a general principle not to apply profits to relief of rates, but to reduce charges, Mr. Rowan said that he strongly objected to lower charges for electricity at the expense of the workers.

The CHAIRMAN suggested that a flat rate increase of 10s. per week would defeat the sliding scale agreement, but Mr. ROWAN replied that the 22s. 9d. decrease had been applied irrespective of the sliding scale, so that he was not creating a precedent.

Mr. WOODHOUSE asked whether the 10s. increase was arrived at on the basis of the ability of the industry to pay, or in relation to other industries. Mr. ROWAN said that the men had lost 22s. 9d. per week and wanted some of it back again.

Questions were put by the chairman as to Mr. Rowan's views upon a more general adoption of arbitration in the industry, but Mr. Rowan refused to go farther than to say that he was presenting the views of the men.

During the course of the discussion it was stated that although the wages in the electricity supply industry went up in sympathy with engineering wages during the war and the subsequent boom, they had not come down to the same extent since.

Mr. H. H. MORTON, secretary to the L.C.C. Electrical Branch Shop Stewards' Committee, closed the case for the employés by presenting figures which he had compiled to show that the economic position of the workers in the industry now was worse, relatively, than it was in 1914.

Alderman WALKER made a brief statement in opening the case for the employers, stating that his principal facts would be given through a number of witnesses. He said, however, that he regarded the men as already overpaid, if anything.

The first witness for the employers was Mr. A. H. BANKS, employers' secretary for the North-Western area, who gave evidence largely by way of discussing many tables of figures, and contended that wages in other local industries must govern the wages of employés in the electricity supply industry. The rates paid to electricity supply workers were not only above the average of local industrial rates, but they were even higher than the highest local rates.

The proceedings were resumed on September 11th. Mr. BANKS, referring to the 10 per cent. reduction in wages which was made in January, 1923, said that in the case of a man receiving 60s. per week, that represented 6s. From that, however, must be deducted 4s., which represented the national payment of 1d. per hour shift-pay, and another 2s., representing ½d. per hour which is in suspense in respect of a fall of six points in the cost of living index. That brought the 6s. down to nil. He would not admit that the average amount of money earned by the engineering worker was more than that earned by the electricity worker. Asked if he considered it fair to base wages in the electricity supply industry, which was prosperous in the whole of the N.W. area, on the wages of industries which had suffered from the severest depression known for 50 years, such as the engineering and textile industries, he said that he did. They must be governed by that depression just as they were governed by the abnormal prosperity previously experienced. Mr. Banks further contended that trade unions were using the electricity supply industry schedules to force up the wages paid in private industries. As the result of further questions as to the amounts received by workers in the engineering trades, it was agreed to get information from typical engineering firms of the amounts actually paid to the various grades.

Asked what the increase of 10s. per week, now demanded, would mean to the industry in the N.W. area, Mr. BANKS said it would amount to £130,000 per annum.

Mr. C. D. TAITE (chief engineer and manager of the Lancashire Electric Power Co., a member of the No. 3 District (N.W. Area) Council, and the National Council for the Electricity Supply Industry), gave evidence on behalf of the power companies. He emphasised the keen competition between electrical and other forms of power, to show that any increase in the cost of producing electricity was a hindrance in the path of development of electricity supply. He pointed out how finely cut were prices at which electricity was sold for industrial purposes, and pointed to the provisions, contained in contracts for electricity supply, for the purpose of adjusting consumers' accounts as the result of an increase or decrease in the rates of wages, local rating, and the price of coal. It might, indeed, be said that the preparation of an offer for a large supply of power had become an exact calculation, and the price finally agreed upon would leave an insufficient margin of profit if any item of cost were to be seriously increased, unless such increase were provided for under the terms of the agreement. The average price obtained by the whole of the power companies for the year ended December 31st, 1923, was 0.963d. per kWh. Commenting further on competition, he said it was most strenuous as between electricity and other forms of driving in cotton mills. He believed he was correct in saying that not more than 10 per cent. of the textile industry machinery was being driven electrically up to the present. If the increase was conceded the companies would be compelled to pass it on to the consumers, who were already urging with great insistence that prices were too high and should be reduced. The return on the capital invested in power companies had never been extravagant. The average return on capital of ten power companies from the commencement of operations to December 31st, 1923, was 3.43 per cent. The average return of ten power companies during the five years ended December 31st, was 4.3 per cent., and the average return on capital of eight power companies for the same period was 5.29 per cent. If the prices

of electric power were higher, other industries would have to pay more for their energy in order that the workers in the electricity supply industry—already in a more favourable position as regarded wages than those in the industries referred to—might have their position still further improved.

Dealing with arbitration, witness said that in the view of the power companies, the natural corollary to a Whitley Council was a Court of Arbitration. If the trade unions were unable to accept this procedure, which had already been agreed to in the case of the National Joint Board which dealt with staff matters, the power companies would prefer to retire from the Whitley Councils and retain a free hand to deal direct with their employés. In the case of his own company, said witness, the increase asked for would increase generation and distribution costs by 5 per cent.

Cross-examined by Mr. ROWAN, witness said that the 10s. per week increase in wages would make a difference of 2½ per cent. in the selling cost of energy. Mr. Rowan suggested that the figures given as to the average return on capital of 10 power companies covered a period of unparalleled industrial depression. Witness would not agree, and pointed out that the last five years, which was the period covered, included a period of very great prosperity.

To Mr. TURNER's suggestion that if an industry were steadily improving, the principle, that labour should share the advantages, ought to be adopted, witness said the difficulty was that, while certain undertakings might improve, others did not, because their areas of supply were of different characters. Therefore, the latter could not pay the higher wages which the former could. In reply to Mr. Woodhouse, witness said that a small reduction in price now would stimulate the use of electricity to a very large extent.

Mr. R. BLACKMORE (engineer-in-chief to the Stalybridge Joint Board) handed in a table of financial statistics relating to the municipal undertakings in the N.W. area, which showed that in no case did the reserve fund reach 10 per cent. of the aggregate capital expenditure. He said that it was practically impossible for any electrical undertaking to supply current to cotton spinning mills of 1,000 h.p. and upwards at the same overall cost, including capital charges, at which the mill-owners themselves could provide power. The only reason why electric power could be sold to spinning mills was that the owners could use for their manufacturing processes the capital which they would otherwise have to use for power plant. They wanted a higher return on the capital than the return with which the electricity supply undertakings had to be satisfied.

On September 12th, Mr. BLACKMORE was further cross-examined by members of the Court and said that in looking at the published surpluses on municipal electrical undertakings account must be taken of the extra depreciation allowances in respect of obsolescence. When this was done, and also if proper allowances were made for reserve to bring these accounts up to the full statutory 10 per cent. of the capital expenditure, it would be found that in the majority of cases the surpluses shown in the accounts would disappear.

Mr. R. RICHARDSON (Hull), representing the No. 2 Area (West Riding of Yorkshire), said this was the only area of the 13 in which the whole wages question had been submitted to an independent tribunal, and a decision was given only 18 months ago. Therefore, he objected to any variation of that so soon after such an inquiry. He also gave figures showing that the electrical workers were more highly paid than those in any other comparable industry, taking the mining, engineering and textile trades, and said that although in certain tables of analysis of electricity supply accounts, Hull was shown as having a profit of £59,684 last year, these profits did not exist, in fact, because they practically disappeared after making allowance for obsolescence and special repairs.

Answering Mr. Rowan, Mr. RICHARDSON said that wages in the industry in the No. 2 Area were 125 per cent. over the pre-war hourly rate, on the average. Mr. Rowan denied that these figures were correct, and claimed that at no time had the electrical workers ever had more than 100 per cent. above pre-war rates.

Alderman WALKER said he was prepared to call evidence from every district to show that if proper allowances were made for depreciation, obsolescence, reserve, &c., the gross profits shown in the returns of electrical undertakings were non-existent.

The CHAIRMAN said the Tribunal was unanimously of opinion that it was not necessary to hear further evidence with regard to disposal of profits or surpluses, or the subject of competition.

Some discussion then took place with regard to a resolution passed by the No. 1 (North East Coast) Area Committee in favour of an increase in wages, the Chairman asking what that really meant and whether it had any relation to the present application.

Alderman WALKER said the position there was that during the trade slump, when the shipbuilding trade suffered so badly, the electricity supply workers in No. 1 area agreed to a special reduction which brought their wages below those of Nos. 2 and 3 areas, which were comparable as regards industrial conditions. The resolution referred to, although passed after the application for the 10s. increase was made, referred to this special reduction and, if the suggested increase in No. 1 area was given, which would amount to an average of 5s. 9d. per week, it would still only bring the wages in that area to slightly below, on the average, those now being paid in Nos. 2 and 3 areas. He contended that that 5s. 9d. was not regarded as a concession of part of the 10s. now asked for.

Mr. ROWAN, on the other hand, said that as the resolution was passed after the present application had been made, it must have some reference to it and meant that No. 1 area was willing to give something of the 10s.

Witnesses were then put forward from all the areas, with the exception of No. 10 (London), who handed in figures and charts showing that in every case the general average of electrical workers' wages was above the average of the principal local industries of the particular areas. All the figures were challenged by Mr. Rowan, who refused to accept them as accurate.

The inquiry was resumed on September 15th, when further evidence was heard and the inquiry closed.

(To be concluded.)

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Commutator Grinding Device.

A new tool for the trueing up of d.c. commutators and slip-rings is being placed on the market by Messrs. PAPE & BENNISON, 23, Stanley Road, Barrow-in-Furness. This tool (fig. 1) is designed to adjust itself automatically to the diameter of the commutator or slip-ring in need of trueing up on pressure only being applied. Four screws, two at each end, are provided to regulate the tension. The principal feature of the tool is the

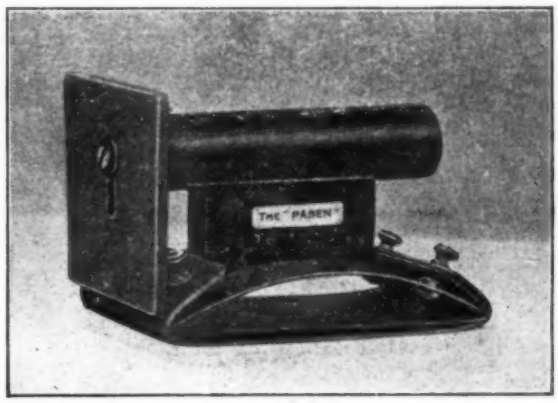


Fig. 1.—The "Paben" Commutator Grinder.

flexibility of its underside spring steel, which allows it to give to the radius of any commutator or slip-ring. To this underside steel is attached suitable insulation and across this is stretched the grinding material—carborundum, emery, or glass cloth. The front of the tool is protected by an adjustable sliding piece of insulation, so that there is no danger of the tool's getting jammed in the brush-gear. Every part is well insulated. Three sizes are made: No. 1 for 12 in. diameters and upwards, No. 2, 8 in. and upwards, and No. 3, 4 in. upwards.

"Ediswan" Radio Apparatus.

We have recently received four pieces of radio-telephone apparatus for test from the EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4—a new pattern of crystal set, a pair of headphones, a potentiometer, and a l.f. inter-

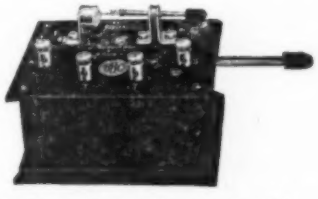


Fig. 2.—A New "Ediswan" Crystal Set.

valve transformer. The receiving set (fig. 2) is very compact and of neat design. The tuning arrangement consists of a rectangular inductance of enamelled wire, over which travels a slider attached to a square bar projecting from the side

of the containing box, and terminating in a small handle. A sensitive crystal and a ball-jointed "Universal" "catswhisker" holder are provided, and the fittings are nickel-plated. The headphones have a total series resistance of 4,000 ohms; they are mounted on a double headband of plated metal, and the cases are of polished aluminium; they fit very comfortably. With the receiving set used in conjunction with the 'phones, the "2LO" programme was heard very distinctly at a distance of over 20 miles from the station. The potentiometer consists of a high-resistance wire wound on a flat fibre strip fitted between two circular ebonite end pieces. A sliding contact, consisting of a spring shoe fitted to the end of a rotating arm, is actuated by means of an ebonite knob; the resistance can be altered by one turn of the wire at a time. There are three terminals mounted on metal extension arms. Two of these terminals lead to the ends of the resistance wire, while the other is connected to the slider. The total resistance is 300 ohms.

The transformer windings are of high-conductivity, silk-covered wire for the primary and enamelled copper wire for the secondary; the ratio is 3.5 to 1, and the insulation between the windings will withstand 1,000 V. The closed iron core is formed from "Stalloy" laminations; the bobbin is fixed firmly, and the outer windings are protected by cloth. In order to avoid the mounting of a separate fixed condenser across the primary winding, a .001 mF condenser is fixed to the top of the brackets.

A Universal Bedplate.

A new type of universal bedplate has been provisionally patented by the POWER MACHINERY TRADING CO., of 17, Queen Victoria Street, London, E.C.4. It has been designed with the object of making it possible for any make of dynamo or motor, or any differently dimensioned machine, to be coupled up on stock rails. The curved rails can be assembled easily to suit centres of machines, holding down bolts, &c., fig. 3 illustrating two of the many forms the bedplate can take. A steel

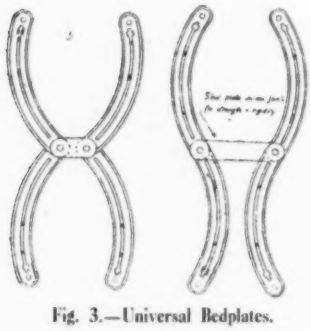


Fig. 3.—Universal Bedplates.

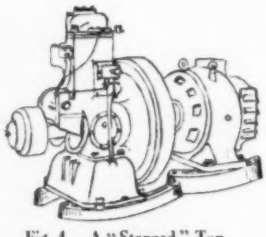


Fig. 4.—A "Stepped" Top Bedplate.

plate is coupled across the joints as shown for strength and rigidity. Fig. 4 is a view of a bedplate suitable for directly-coupled machines having different shaft heights, the bedplate having a "stepped" top to carry the dynamo. It is claimed that the cost of the new type is practically half that of a solid bedplate and, moreover, a great deal of trouble is avoided by the elimination of wrongly drilled holes, &c.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

5,353. "Communication by the aid of high-frequency currents." W. Dubilier. February 23rd, 1923. (220,667.)

7,972. "Cabinets for use in connection with wireless receiving apparatus." E. A. Graham. March 20th, 1923. (220,674.)

8,170. "Terminal fittings and fittings for leading electric conductors into casings." R. H. Barbour and J. R. Walton. March 22nd, 1923. (220,678.)

8,235. "Electric telemotor apparatus." M. P. Laughlin. March 22nd, 1923. (220,682.)

10,794. "Electric switches." P. O. Dorer. April 20th, 1923. (220,686.)

10,994. "Electric cables." F. H. Broomfield and N. J. Austin. April 23rd, 1923. (220,689.)

11,244. "Electric discharge tubes provided with two or more electrodes." Naamlooze Vennootschap Philips Gloeilampenfabricken. October 21st, 1922. (205,784.)

13,164. "Electric heaters." British Thomson-Houston Co., Ltd. (International General Electric Co.). May 16th, 1923. (220,699.)

13,684. "Electric condensers." W. Dubilier. May 23rd, 1922. (198,362.)

13,756. "Electric control systems." Igranic Electric Co., Ltd., and M. J. Rantzen. May 24th, 1923. (220,722.)

13,771. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 11th, 1922. (203,655.)

13,793. "Holder or support for a valve such as is employed in wireless telegraphy or telephony." O. W. Walker. May 25th, 1923. (220,724.)

13,880. "Thermionic valve arrangements." E. A. Graham and W. J. Rickets. May 25th, 1923. (220,727.)

13,950. "Electric contact or terminal." A. E. Chapman. May 26th, 1923. (220,731.)

13,964. "Electrical or electro-mechanical cut-out or automatic safety devices for use with power transmission apparatus." G. W. Muscord. May 26th, 1923. (220,733.)

14,371. "Method of and means for supplying electrical power to railways and tramways." Sir P. Dawson and F. W. Fawdry. May 31st, 1923. (220,736.)

14,399. "Protective apparatus for alternating electric current systems." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. May 31st, 1923. (Cognate application, 25,136/23. Addition to 193,434.) (220,737.)

14,633. "Electric transformers." A. E. L. Scanes and Metropolitan-Vickers Electrical Co., Ltd. June 4th, 1923. (220,741.)

14,879. "Adjusting mechanism for tuning and like devices in wireless apparatus." Sterling Telephone & Electric Co., Ltd., and W. M. Holbeach. June 6th, 1923. (220,744.)

15,128. "Receiving apparatus for high-frequency signalling systems." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. June 9th, 1923. (220,745.)

15,305. "Electric tube devices having coiled filaments." E. Y. Robinson. June 12th, 1923. (220,747.)

15,346. "Transmission of electric signals." J. L. Semat. October 9th, 1922. (205,048.)

15,736. "Rotors of high speed dynamo-electric machines." Lancashire Dynamo and Motor Co., Ltd., and C. P. Bramley. June 18th, 1923. (220,755.)

16,680. "Galvanic batteries." Fuller's United Electric Works, Ltd., and L. Fuller. June 27th, 1923. (220,763.)

16,733. "Wireless receiving circuits." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. June 27th, 1923. (220,765.)

17,450. "'Loud-speaking' telephonic receivers." C. H. Johnson. July 5th, 1923. (220,770.)

18,069. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. July 12th, 1923. (220,774.)

18,275. "Rotating and self-adjusting clip for holding mineral specimens, rectifying crystals for wireless reception, and the like." S. Eden-Green. July 16th, 1923. (220,775.)

18,729. "Means for the electroaviatic exploration of the earth's interior, and for determining the height of aircraft from the ground." Dr. H. Lowy. July 20th, 1923. (220,779.)

19,305. "Electrical potential dividers." B. A. G. Churcher and Metropolitan-Vickers Electrical Co., Ltd. July 27th, 1923. (220,785.)

19,916. "Telephone receivers." Fuller's United Electric Works, Ltd., and A. P. Welch. August 3rd, 1923. (220,794.)

20,517. "Bonding-clips for electric wiring systems." Callender's Cable and Construction Co., Ltd., and S. J. Bryce. August 13th, 1923. (220,800.)

20,536. "Searchlights and the like." A. K. Toulmin-Smith. August 13th, 1923. (220,801.)

20,990. "Electrical condensers." Hawkers, Ltd., and E. R. Gardner. August 18th, 1923. (220,806.)

21,680. "Electric warning horns." Harris & Sheldon, Ltd., and T. E. Sellers. August 28th, 1923. (220,810.)

22,771. "Lamps for illuminating motor-car dashboards." R. W. St. G. Caulfield. September 11th, 1923. (220,820.)

23,419. "Wireless receiving apparatus." W. S. Worthington. September 19th, 1923. (220,825.)

25,229. "Alternating-current arc welding apparatus." F. Schmidt. October 10th, 1923. (220,840.)

25,743. "Devices for the automatic connection of electric conductors to terminals." A. G. P. M. Poirault de la Porte. May 16th, 1923. (216,086.)

28,889. "Automatic safety devices for protecting low-tension electric circuits." I. Guiducci. November 15th, 1923. (220,856.)

29,985. "Apparatus for detecting subaqueous sound signals." Atlaswerke Akt. Ges. November 28th, 1922. (207,815.)

29,989. "Oil-insulated electric transformers and the like." Sachsenwerk Licht-und Kraft Akt. Ges., W. Safert, and F. Haberle. November 28th, 1923. (220,861.)

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193. "Detectors for use with crystal wireless apparatus." R. H. Winter. January 3rd, 1924. (220,879.)

647. "Means for supplying current to radio receiving sets." Marconi's Wireless Telegraph Co., Ltd. January 9th, 1923. (209,740.)

1,483. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). January 18th, 1924. (220,887.)

2,606. "Asynchronous induction motors with compensation of the phase displacement." Dr. T. Torda. January 31st, 1923. (210,789.)

5,251. "Lead electrodes for accumulators." A. Strasser and C. Muller. March 8th, 1923. (212,542.)

6,378. "Portable electric light fixtures." A. E. White (Vaslamp Manufacturing Corporation). March 12th, 1923. (220,894.)

11,722. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). May 12th, 1924. (220,907.)

11,944. "Electrolytic condensers." A. Soulier. May 14th, 1923. (216,139.)

12,001. "Electric signalling systems." British Thomson-Houston Co., Ltd. May 19th, 1923. (216,147.)

A Large Frequency Changer.—Among the features in the recent development of the Brooklyn Edison Co.'s power system is the installation of a 35,000-kVA frequency changer which will be used for exchanging power between the 25- and 60-cycle systems. It is located in Brooklyn, New York, adjacent to the Gold Street station. In point of size, it is the largest electrical unit in existence. The base measures 45 ft. by 22 ft. and 21 ft. from the bottom of the air intake to the top of the air discharge hood. The machine is, therefore, fully 21 ft. high from the foundations. The shaft upon which it revolves is 14 in. in diameter, and the largest rotating part is 14 ft. in diameter. The total weight of the machine is 460 tons, and the weight of the rotating part is 280 tons. The four bearings are cooled by water circulating continuously through jackets surrounding the bearing surfaces. In order to provide for easy starting, oil is pumped into the bearings and under the shaft so that the entire rotating part is lifted clear of the bearing and supported on a thin film of oil. Several oil pumps, working at a pressure of 1,200 lb. per sq. in., are provided for this purpose. The full speed is 300 revs. per min., a peripheral speed of about two and three-quarter miles per minute for the largest rotating part; it requires 45 min. to coast from full speed to dead stop.—*A.I.E.E. Journal.*

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